1789
XLIII

FLIGHT

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OFFICIAL ORGAN OF THE ROYAL AERO CLUB

APRIL 8th, 1943

MTBs Raid Big Convoy Off Sicily

THE Admiralty announced last night that a small force of motor-torpedo boats, operating south of Marittimo in company with aircraft of the R.A.F. carried out an attack on a powerfully escorted enemy convoy on Monday night. Marittimo is an island off the south-west coast of Sicily.

It was this convoy which, it was earlier reported, was attacked by torpedo aircraft, which left an enemy tanker blazing from stem to stern. Despite the strong escort, the attack made by the M.T.B.s was pressed home and a torpedo hit scored on one of the ships in the convoy.

The M.T.B.s also observed a large enemy ship sink after being hit by a torpedo from one of our aircraft.

Reprinted from the "Daily Mail," 19-2-43.

High tide or low, in weather fair or foul M.T.Bs. ride the seven seas

The Prototype of the M.T.B. the Mosquito and P.T. boats in service to-day under the flags of the United Nations was designed and built by

THE BRITISH POWER BOAT COMPANY LTD.

Constructors of Scott-Paine Surface Craft

BRITAIN'S STRENGTH IN THE SKIES

"BEAUFIGHTERS OF COASTAL COMMAND SHOOT DOWN THREE NAZIS"

"BRISTOL" BEAUFIGHTERS, on day and night patrol over the Bay of Biscay, recently shot down a Focke-Wulf Kurier and two out of three Ju 88s sent out to protect lurking U-Boats which were trying to creep out into the Atlantic. (AIR MINISTRY BULLETIN.)

BRITISH WORKMANSHIP AT BEST — Bristol

THE "Bristol" Beaufighter

BRITAIN'S LONG-RANGE TWIN-ENGINED FIGHTER

FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Standards for Squadrons

IT was a happy inspiration which prompted His Majesty the King to award standards to squadrons of the Royal Air Force which have qualified by length of service or by virtue of outstanding achievement in operations. No more suitable way of marking the twenty-fifth birthday of the Royal Air Force could have been conceived.

What exactly is meant by length of service is not clear at the moment, for some squadrons have had a continuous existence since 1918, while others have been disbanded and subsequently reformed, while others (including all the units of the Auxiliary Air Force) have come into existence since the end of the first world war. Perhaps length of service in some particular area, such as the Western Desert, may be meant, but the clause is even more likely to apply to squadrons of Coastal Command which may have put in thousands of hours of patrol without ever having had the luck to sink a U-boat.

An R.A.F. squadron will certainly never be able to fly its standard in action; but neither can cavalry or infantry regiments in these days. When the Army fought mostly in red tunics the colours were the rallying point in battle, and to lose them to the enemy was the worst sort of disgrace. Regimental battle emblems, which have not always been flags, have a most interesting history, and one seems to remember that it was the Eagle-bearer of the Tenth Legion who was the first Roman to land on the shores of Britannia when Cæsar made his first expedition across the Channel. At Chelsea Hospital (in peacetime) one can see the Eagle of one of Napoleon's regiments which was captured by Serg. Ewart of the Scots Greys at Waterloo. Another gallant feat was the saving by two officers of the Colours of the Twenty-fourth Regiment when the Zulus cut the regiment to pieces at Isandhlwana.

Of recent years the Colours have become merely the outward and visible sign of the spirit of the regiment. On ceremonial parades they are always guarded by a colour party under the command of an officer (Ensign was once the title of the lowest rank of infantry officer) and they are always saluted by officers and soldiers who pass them. Some analogous ceremonial will have to be drawn up for the standards of R.A.F. squadrons. The majority of the members of a squadron do not fly, and the squadron as a whole can only parade for ceremonial purposes on the ground. Undoubtedly the squadrons which receive standards will feel highly honoured, and will treat them with due ceremony. Presumably the heraldic badges of the units and their battle honours will be embroidered on the standards.

Engaging the Gears

CONSIDERABLE interest in rotating-wing aircraft has been aroused by the article published in our issue of March 25th. Curiously enough, many requests for further information have come from the aircraft industry, a section of the community which has not hitherto been noteworthy for a pronounced belief in "whirligigs." The suggestion has been made to us that it would be a good idea to bring together all those who, now scattered over the country and working independently, have experience of, or are interested in, the subject of rotating-wing aircraft. The argument is that by pooling ideas more rapid progress would be made.

From the article on helicopters, published in this issue, it is fairly clear that the pioneers in this field of endeavour have laid the foundations for future builders. What

one might term the aerodynamics of rotary-wing flight are now pretty well understood. When, however, it comes to translating the requirements into mechanical engineering, there is obviously room for new ideas.

The heart of the whole problem is the rotor head. Blades may be attached to it in many ways. Control may be by tilting the whole rotor head, or by a cyclic change of pitch angles in addition to the simultaneous change in pitch of all blades for climbing and descending. That is a main mechanical problem. Coupled with it (literally as well as figuratively) is that of mechanism for ensuring autorotation in case of engine failure. If this is automatic there must be an overriding control for the pilot, otherwise conditions might arise in which the blades went into fine pitch at an inopportune moment.

Transmission of power is another part of the mechanical problem. It may be by shafts and gears (it always has been hitherto), but some form of hydraulic transmission cannot be ruled out. There is even the possibility of jet propulsion of the blades, although the vision of a flaming, whirling torch above the fuselage is somewhat terrifying. We believe we are right in thinking that many years ago the late Señor de la Cierva did take out patents for starting the rotor blades of the Autogiro in this way.

The Threat to Tokyo

IT is reported that the Americans have now established a base in China from which their long-range bombers will be able to raid Tokyo. This is extremely good news. It is by no means certain that even a devastating raid on the residential parts of the Capital of Nippon would have much effect on the "will to win" of the Japanese people, and still less would such a calamity be likely to soften the arrogance of the Government. But there are all sorts of other prospects about an air attack on Japan. It is a small country, and its war factories cannot be dispersed to anything like the same extent as those of Germany with its occupied and satellite countries. The resources of Japan are strictly limited, and any interference with the output of warlike supplies would have a much more direct effect on the war effort of the country than can be achieved by much bombing of Hitler's factories.

It is not generally known where the main battle fleet of Japan has its chief base during the present hostilities; but if an important part of it could be found and bombed in Yokohama or another home port, it might shorten the Pacific war very greatly. The Japanese have lost heavily already in cruisers and carriers. Aircraft factories, too, would be very tempting targets, and the destruction of some of them would go far to hamstring the fleet.

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R.A.F.'s 25th ANNIVERSARY

The King's Message of Congratulation

"On this, the 25th anniversary of its formation, I send my heartfelt congratulations to the Royal Air Force at home and overseas. To me personally it is an anniversary of deep significance, for it was on this day, in the year 1918, that I was first absorbed into the force, and there began for me an association of which I have never been prouder than I am to-day.

"In the quarter of a century that has passed since the Royal Air Force assumed its present name, it has won—and daily continues to win—imperishable renown. It is not so long ago that, greatly outnumbered, it hurled back the mighty armadas launched against these islands as a preliminary to invasion and our destruction. Now, powerful and well armed, its squadrons are everywhere deployed for the attack. Across the high seas, in collaboration with the Royal Navy, it strikes relentlessly at hostile shipping; in proud partnership it shares the triumphs of our armies in the field; and, in its own sphere, it penetrates by day and night the enemy's most formidable defences, to aim crippling blows at his bases and arsenals, at the nerve-centres of his resistance.

"Fighting side by side with the gallant air forces of the Dominions and of our Allies, it has indeed established a clear ascendancy over our enemies. This supremacy of the air is due in part to the fighting qualities of the operational squadrons: in part, to the devoted skill of the ground staffs, both men and women; and in part to the magnificent training organisation built up throughout the Empire. But its prime cause, beyond question, is the spirit which inspires each and every member of the force—the spirit that attains the stars, however hard the way may be.

"It is my constant prayer that good fortune and success may ever be vouchsafed to the Royal Air Force and to all who serve in it."

GEORGE R.I.

THROUGH THE WINDOW: A convoy of tankers for N. Africa seen from an escorting Hudson.

New Battle Tactics at El Hamma : Great Raid on Sardinia : Berlin Bombed Again : German Efforts in Russia

SOME new tactics have recently been used in the battle for El Hamma which turned Rommel's flank and resulted in his having to evacuate the Mareth Line. The Prime Minister spoke mysteriously about the matter when he announced the victory in the House of Commons, saying "the decisive break-through of General Freyberg's turning force was aided to an extraordinary degree by novel forms of intense air attack, in which hundreds of British aircraft were simultaneously employed." A few days later Cairo correspondents gave what we can only consider a partial explanation of these words by stating that for the first time heavily armed fighters were used against German tanks actually drawn up for battle.

There may have been some new weapon used, and new weapons usually call for new applications of the rules of tactics. In any case intense interest must attach to any new form of tactics which enables the air arm to take a direct part in a ground battle, whether it fights with new weapons or with old. It seems clear that the Western Desert Air Force under Air Vice-Marshal Broadhurst, has evolved something novel in the tactical line, something more effective than has ever been used before, and it may prove that this is the most important development in the use of the air weapon which has been engendered by this war.

Of course the public was told some time ago about the tank-buster Hurricane, called in North Africa the "can-opener," so Mr. Churchill's words could not have referred merely to the use of this type. And it may be mentioned that official opinion in London has not considered that the tank-buster aircraft would prove an adequate substitute for guns or British tanks when dealing with enemy tanks, though it would be a useful addition to the anti-tank armoury. However, Northern Africa has been the academy and testing ground for the once-neglected science and art of air support for an army. "Something new out of Africa" is an old saying, and it seems to be still true.

Last week we recorded a raid on Berlin on March 27th, in which 900 tons of bombs were dropped. Within 48 hours Bomber Command sent another force over the German capital, and more destruction was done. In that raid 21 machines were lost, and another 12 over the Ruhr. The fact that both Berlin and the Ruhr can now be raided on the same night is very significant. The news of the raids on Berlin is said to have had a very heartening effect in Russia. Of all the United Nations still able to fight and to recover ground which the Germans had occupied, the Russians have the most intimate knowledge of the utter bestial cruelty of which the Germans are capable, and they rejoice to hear that the enemy has no monopoly of inflicting suffering, but can be made to suffer himself even in the capital which Göring had declared inviolable.

The Germans have been making a strong effort to dominate the air in their attacks on the Russians in the Donetz Basin, and it is said that sometimes there have been as many as 100 fighters and bombers of the *Luftwaffe* in the air at the same time on the sector Chuguyev-Izyum. The reports add that in spite of their numbers the Germans have not achieved air supremacy, though air superiority seems likely. The Red Air Fleet has

WAR IN THE AIR

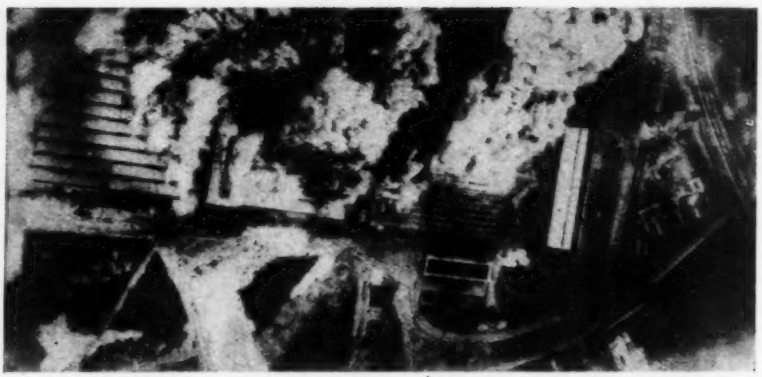
been able to hold its own to a sufficient extent to prevent the enemy from having things all his own way. In short, the *Luftwaffe* in Russia has failed to do what the R.A.F. has achieved in North Africa. The effort, to be strong on both fronts must be taxing the German air resources to the uttermost, especially when one remembers that a very large proportion of fighters is kept in Northern France. The number there recently was a good half of the German fighter strength; that may have been reduced by now, but it can hardly be very much reduced without great risk. In addition to the claims of the two existing fronts, the Germans have to be prepared for a possible Allied invasion in Northern Europe, and the recent statement by Mr. Morrison about "regulated areas" round the coasts of Britain must have added to their anxieties.

A Raid on Sardinia

Probably even the Germans were surprised, as most people in this country have been, to realise that the Americans in North Africa have accumulated a force of nearly 100 Fortress bombers. When one thinks of the great quantities of ground equipment needed before a squadron of heavy bombers can operate efficiently, one must marvel at the effort which has established such a formidable force so far from home. External lines give a considerable advantage to the belligerent which commands the seas, but that principle has hardly ever been more strikingly demonstrated than in this African campaign—at least since Wellington's Army was landed in Spain for the Peninsular campaign.

The port and air bases of Cagliari, in Sardinia, were selected as the witness of this surprising growth of American air power in the Mediterranean. The attack was not entirely an American show. On the night of Tuesday, March 30th, R.A.F. Wellingtons raided the airfield of Decimomannu, in the neighbourhood of Cagliari, and lit many fires. Then on the following day the Fortresses came over by daylight and attacked the port and all the three airfields near by. The damage done is said to have been very extensive, and a number of Axis ships were hit. Particularly gratifying was the effect of one bomb which penetrated an underground fuel storage depot at Decimomannu and set it on fire. It must have been a lucky hit, of course, but it must also have been a very beautiful bomb—or else the construction of the underground depot was a particularly slovenly piece of Italian workmanship. The clear atmosphere of the Mediterranean is very suitable for the special tactics of Fortresses, namely, altitude bombing in daylight.

The Western Desert Air Force celebrated the 25th birthday of the R.A.F. by making the largest single raid yet carried out in Africa. The target was the airfield at Sfax, El Maou by name, and nearly 100 light bombers took part. Despite a fierce barrage from the ground none of our aircraft was lost. The smoke covered the target, and results could not be accurately observed, but it is to be hoped that this raid still further reduced the ability of the Axis to dispute the supremacy in the air held by the United Nations.



ANOTHER RENAULT ATTACK: Bombs exploding in the Le Mans Renault works during an attack by Mosquitoes of Bomber Command.

The Position

The position in Tunisia now is very interesting, with the Axis holding a comparatively narrow but very defensible strip along the coast, in which there is not much room to manœuvre, while the United Nations attack from the south and all along the western edge of the strip. Rommel showed judgment, as usual, in holding the Mareth Line just long enough, and yet withdrawing his troops in good time. He inflicted losses on the Eighth Army, and he suffered losses himself. It is believed that his losses were considerably the heavier, but details are not yet known. He delayed General Montgomery for a few days, and delay is obviously one of the strategic objects of the Axis in holding out in Tunisia. There followed a retreat across the front of the forces which General Eisenhower brought to Africa, in which Rommel was covered by flank guards, but all the while was subject to furious attack from the Allied Air Forces, while the Eighth Army followed up behind him as hard as it could go.

The supply lines of the Axis in Africa are by sea, covered by the Italian "fleet in being" but assailed by submarines and air attacks. While the Italian fleet remains in being the British Navy cannot come out in its

BRISTOLS IN BURMA: Blenheims making low-level attacks on Japanese shipping in Akyab harbour.

WAR IN THE AIR

ENEMY AIR LOSSES to APRIL 3rd

	Over G.B.	Over Continent	Middle East
Mar. 28	2	0	0
,, 29	1	2	0
,, 30	0	0	0
,, 31	0	0	0
April 1	0	0	0
,, 2	0	0	1
,, 3	1	5	0
	4	7	1

Totals : West, 6,753 ; Middle East, over 5,271 ; North Africa, 1,020.

strength and sweep the supply ships off the seas. Undoubtedly Admiral of the Fleet Sir Andrew Cunningham would like nothing better than a pitched battle with the Italians, but they have been too wily to give him the chance. Italian naval policy has not been highly glorious, but up to a point it has paid. Unfortunately, the submarines and the aircraft cannot prevent all the Axis supply ships from slipping across to Tunisia, especially by night.

Last Saturday an American formation of Spitfires gained a very striking victory over a superior number of Stukas, escorted by 14 German fighters, near El Guettar. At least 14 of the Stukas were shot down in a running battle, and only one Spitfire was lost. The extraordinary thing was that only one Me 109 attempted to save the Stukas, and it was driven off. The suggestion that German pilots in North Africa have begun to show signs of breaking nerves seems to be not without foundation.

R.A.F. GUARDS : The R.A.F. Regiment taking over from the Coldstream Guards at Buckingham Palace. They mounted guard for four days during the celebration of the 25th birthday of the R.A.F.

BY BOEING AND BY SPERRY : A direct hit on a Japanese transport in the Bismarck Sea. The three escort vessels are taking violent evasive action.

The Western Front

LAST week-end saw another very heavy raid on Essen by the R.A.F. at night and one by American bombers next day upon the Renault works at Billancourt outside Paris. In the former the Krupps works were again extensively hit, and during the raid two very large explosions were seen by our aircrews. At the height of the raid 4,000 lb. bombs were falling at the rate of six a minute. Unfortunately, 21 of our bombers were lost, but Essen is known to be one of the most strongly defended towns in Europe.

The bombing war over Europe has shown that even extensive damage can be repaired in a comparatively short time. The Renault works had once before been badly knocked about by Bomber Command, but evidently repairs had made enough progress to call for another visit from the Allies. There was not much defence over Billancourt, but on the way back the Fortresses and their fighter escort had to fight hard. Four American bombers and seven Allied fighters were lost, but the Germans suffered much more heavily. There were other sweeps during the day as well, three operational Commands of the R.A.F. being in action ; and, apart from the damage done to targets on land and sea, the German losses in air combat were numerous.

BRITISH & U.S. AIR LOSSES to APRIL 3rd

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Mar. 28	0	5	5	0
,, 29	1	33	0	0
,, 30	0	0	0	0
,, 31	0	2	4	0
April 1	0	0	0	0
,, 2	0	2	0	0
,, 3	0	22	1	0
	1	64	10	0

Totals : West, 5,513 ; Middle East, about 2,086 ; North Africa, 423.

FROM THE C.A.S.

The message from *Air Chief Marshal Sir C. Portal*, Chief of the Air Staff, to all ranks of the R.A.F. on April 1st, 1943 :—

"To-day we celebrate the 25th birthday of the Royal Air Force. Looking back over these 25 years we can feel with pride that the splendid traditions handed over to us in the last war by the flying services of the Army and of the Royal Navy have been safe in our keeping.

"Starting the present war with small numbers but with high intentions, our Service has already done great deeds. One of the first tasks was to command the air over our own islands to preserve them from invasion, and the battle in which this was done will never be forgotten. Now, thanks to the help of scientists and engineers and many public services, thanks to the efforts of the aircraft industry, thanks, above all, to the support of our people both here and beyond the seas, who have given so many of their sons and daughters to serve in our ranks, we have forged the mighty weapon which the R.A.F. is to-day.

"While sharing ever more closely the fortunes of the Navy and the Army in the war over sea and land, our own Service is now striking with great and growing strength at the heart of the enemy. As we look forward over an ever-widening horizon where fresh opportunities await us for the service of our King and country, let us dedicate ourselves anew to our great task so that in company with the air forces of the Dominions and of our Allies we may play our part worthily in the winning of victory."

British Mission to U.S.A.

Reflections of Sir Roy Fedden, Following Aircraft Engineers' American Tour

SIR ROY FEDDEN, who, with eleven aircraft engineers, has recently returned from a visit to the leading factories of the U.S.A., gave his impressions to a Press gathering on Monday. The object of the mission was to assist production on both sides of the Atlantic and also to look into certain technical questions needing discussion. Sir Roy spoke feelingly of the excellent reception his mission was accorded. There was no delay in pairing up with their opposite numbers at American factories, and every assistance was readily forthcoming. They were able to interview technicians, production experts, and Army and Navy technical representatives at various points, their travels including 10,000 miles by air..

What impressed the mission more than anything else was the growth of the American aircraft industry and the tremendous effort which was being put forward. As an example, he said that in 1939 the U.S. car industry was seven times greater than ours. Today the U.S. aircraft industry was three times greater than their car industry of 1939. As far as workpeople were concerned, whereas in 1939 50,000 were employed, and in 1941 500,000, the present total was 1,500,000 operatives, which would expand by another 1,000,000 by the end of the year.

Sir Roy felt that they had learned a great deal concerning jigging and tooling on aircraft, particularly as the scale and lavishness of equipment were so impressive. He admitted that certain grave mistakes had been made by car people, who had overdone the tooling, but by and large their vision was magnificent. He praised the magnificent buildings, the lighting, and the speed with which new factories were erected and put into production.

Women Workers

America does not yet employ so many women as we do—25 to 30 per cent. representing female labour on aircraft, and 10 to 15 per cent. on engines and airscrews. He praised the American War Production Councils for the interchange of experiences and opinions, one operating on the West and one on the East coast. These councils were valuable since they collated the experiences of factories 3,000 miles apart. He thought the handling of material was better in this country than in America, and their sub-contracting methods were not so good. Many unfinished parts were transported for long distances for final machining operations.

Sir Roy's committee praised particularly the lofting and photographing processes now commonly used in America. He estimated that 50 per cent. of time was saved by abolishing blue prints; he was anxious to see the practice extended in this country also. The American system of utilising conveyors for line assembly he particularly praised as well as the new welding technique to which the mission was introduced. He also praised the Packard method of stripping and rebuilding Rolls-Royce engines, after test, by a rotary conveyor system, and added that they had brought back a new silver-lead bearing for engines.

Labour in America worked 48 hours in a six-day working week, and there was no piece work.

SIR ROY FEDDEN.

It was interesting to find Sir Roy confirm the view that, generally speaking, American aircraft designers appear to be more "production minded" than British. He mentioned as examples of aircraft types designed for ease of production the North American Mustang and the Bell Airacobra. There was closer collaboration between design and production than in this country. The British mission was impressed by the size of American engineering staffs, which were about five times as large as ours. Consequently they got more brains on a job and got it out quickly.

The mission saw with some envy the amazing research establishments. At one, for example, there was a wind tunnel of 24ft. diameter, capable of a speed of 500 m.p.h. in which conditions up to 50,000ft. could be simulated.

Altogether the mission received fine help from all sides, and no information was withheld. As an example of how America achieves rapid progress Sir Roy told of a man who previously manufactured electric washing machines. He was now developing power-driven gun-turrets. Some of the new American turrets, originally based on Frazer Nash and Boulton Paul designs, were, he thought, ahead of ours.

Visits to several repair depots impressed the mission greatly. At the Navy Repair Depot at San Diego they were repairing surprisingly large numbers per month, and the work was equal to any done by the Rolls-Royce and Bristol firms of this country.

Concerning American transport aircraft, he referred to all the familiar types and mentioned one new one, being produced by the Budd concern. It is an all-steel machine (and presumably spot-welded.—Ed.).

Turning to the subject of training, the mission was very impressed by the new American training types, some six to eight of which were now coming into use. Stressed-skin construction was being used, and there was full equipment such as flaps, variable-pitch airscrews, etc.

Engine Production

On the subject of engine-production methods the British visitors did not appear to learn quite so much. That was natural because America had not been in large-scale production for as long as we, and consequently we were more on an equal footing in that respect. Sir Roy mentioned some new powerful engines which were seen on test, but again no information may be published.

Reverting to the size of American technical staffs, admiration was expressed for American training facilities. For example, last year no fewer than 1,400 took degrees. Thus the volume of knowledge which was being concentrated on aircraft problems was enormous, and he hoped that we in this country would press strongly for better technical education facilities.

The mission was surprised to find that in some of the American States there was an almost complete lack of knowledge of what Great Britain had done and was doing in the war. They had, for instance, no idea that a great number of American factories were paid for by this country before Lease-Lend came into being, and thus did not realise to what extent our foresight in placing orders in America long ago had helped not only us but America.

Two things Sir Roy Fedden wanted to plead for as strongly as possible were: better facilities for technical education and vastly extended research equipment.

Rotating-wing AIRCRAFT

A new version of the Sikorsky helicopter. Noteworthy are the cabin and the tricycle undercarriage. An airscrew at the stern takes care of the torque reaction from the single rotor

Second Article in the Series : Helicopter Problems and Progress

THE history of helicopter development is a long one, and in the space available we cannot deal with every phase of it, nor with every experimental type built or designed in this country, France, Germany, Austria, Hungary and the United State of America. Doubtless each one of these types taught its designer something, but there were many which cannot be said to have added materially to the common fund of knowledge of this very intricate and complicated subject.

IN our issue of March 25th was outlined the history of gyroplanes, from the first faltering steps to the jump-start machines which were intermediate between wind-milling and power-driven rotors. The present article summarises helicopter developments up to the outbreak of war.

Encouraged by prizes, many French inventors devoted a great deal of time and thought to helicopter design, and several machines were built, some of which made short free flights, others never getting beyond the "tethered flight" stage. Names that became well known in connection with helicopters during the years after the war 1914-18 were: Damblanc, de Bothezat, Pescára, Oemichen and Breguet. Of these the designer who achieved the nearest approach to success was Louis Breguet, the well-known French aircraft constructor, and his machine will be dealt with in these notes.

In Germany the Focke-Wulf company of Bremen made considerable progress, and at one time their machine held all the world's records for helicopter flight. It may be mentioned, in this connection, that the Focke-Wulf concern held the German rights in the Cierva Autogiro patents, and licence to build Autogiros in Germany. Previously, Dr. Adolf Rohrbach had investigated a helicopter using a totally different arrangement of the lifting surfaces. Both these designs will be referred to later.

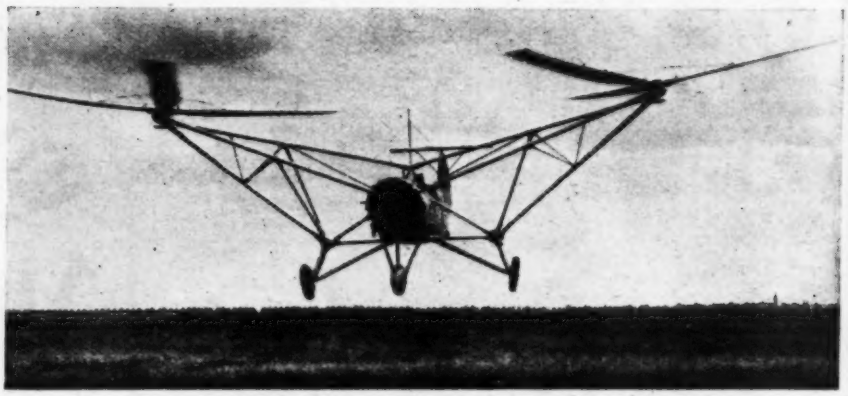
In Great Britain the history of helicopter development is a chequered one. Backed by Government funds Mr. L. Brennan, the inventor of the monorail railway, was able to design and build a helicopter shortly after the war 1914-18. The machine did not promise very well at any time, and ultimately wrecked itself in the large shed at Farnborough. In the meantime, the Air Ministry decided to offer prizes totalling £50,000 for the helicopter which should first fulfil certain specified performance conditions. The Brennan was not eligible, and thus, obviously, the Air Ministry had little faith in its ability to achieve the stipulated performance. Some 15 or 16 entries were received, but no competition ever took place, and presumably the offer is now "dead."

While the British Air Ministry has done little to foster helicopter development, it *can* claim to have encouraged rotating-wing aircraft of the gyroplane type to some extent. For instance, there was the Isacco "Helicogyre," which was just about the craziest contraption anyone could have

ANGLO-AUSTRIAN CO-OPERATION : The helicopter experimented with at Heston some years ago by Messrs. Hafner and Nagler was of the single-rotor type. The "folded wings" counteracted torque.

D

ROTARY-WING AIRCRAFT



The German Focke-Wulf FW 61 at one time held all the world's records for helicopters. They were beaten later by the American Sikorsky VS-300.

seen in a nightmare. It had a four-bladed rotor, each of which carried at its tip a Bristol Cherub engine driving a small airscrew. In the nose there was a Genet engine. Needless to say, the Helicogyre was no more of a success than was the Brennan.

The United States of America became "helicopter-minded" some four years ago; at least sufficiently so to vote a sum of two million dollars for helicopter development. The American designer who has progressed farthest is Igor Sikorsky, whose machines will be described in some detail, and from whom the British Government has now ordered a substantial number of machines for anti-submarine work. At least two British firms were experimenting before and during the early part of this war with helicopters, and had the authorities not closed down on that work it is not unlikely that we should have had practical helicopters flying here now.

Before describing the work of some of the more successful helicopter pioneers, it may be of assistance to outline briefly the fundamental problems which these pioneers had to solve. That it is possible to obtain direct lift from a large airscrew rotating in a horizontal plane has been known from the earliest days. The two main problems of how to make practical use of that lift are mechanical and aerodynamic.

The mechanical difficulties are many and serious. In fact, they may now be said to be greater than the aerodynamic. The work of Cierva, Hafner and others has settled the main aerodynamics of rotating wings, but mechanically there are many ways in which the desired results may be obtained. There are also several aerodynamic solutions, but they appear to be fewer, and the one ultimately chosen will largely determine the corresponding type of mechanical design adopted.

From fundamental considerations it is obvious that a single rotor driven by the engine will give a torque reaction in the opposite direction to that of rotation. Thus if no steps were taken to counteract this torque reaction, the whole machine would turn around its vertical axis in a direction opposite to that in which the rotor was being driven.

Torque Compensation

The obvious way out of the difficulty, and that taken by most experimenters, is to use two rotors running in opposite directions so that the two torques cancel out. Equally obviously, there are two ways in which two rotors can be used: they can be mounted side by side, or they can be mounted coaxially, one above the other. With the former arrangement it is necessary to carry the rotor heads on long outriggers. For lightness these are usually made of girder form, and consequently they offer a great deal of air resistance when the aircraft begins to move forward. Thus the type of helicopter with two side-by-side rotors is likely to be an inferior aircraft in the matter of performance.

When the rotors are mounted coaxially, one above the other, and run in opposite directions, the torques cancel out as in the case of the side-by-side arrangement, and a single pillar, which can fairly readily be streamlined, can take the place of the two outriggers. Thus a great deal of air drag is saved. From that point of view the coaxial rotor arrangement appears attractive, but as in all aircraft engineering one comes up against a corresponding disadvantage, and a compromise has to be made. It has been found that the lower rotor is less efficient than the upper. Senor de la Cierva found that out in his first autogiro, and the same conditions obtain with a mechanically driven as with a windmilling rotor.

The lower rotor is working in air which has already been given a downward movement, and it might be expected, from a superficial examination, that it would suffice to give the lower rotor blades a slightly coarser pitch angle than those of the upper. However, the air has also been given a twisting motion by the upper rotor, and this has the effect of virtually increasing the aerodynamic pitch angle of the lower blades, so that their geometric pitch angle has to be decreased. The trouble does not end there. In a lifting airscrew the

In the French Breguet helicopter the coaxial rotors were spaced far apart, but even so the blades hit one another (they were free to "flap").

The German Rohrback "paddle plane" was a helicopter design to a different formula. The rotor blades had their incidence varied as they travelled around the circumference.

relative magnitude of axial and rotational airflow in the slipstream changes with the flight path of the machine, and will be different according to whether the machine is hovering, climbing vertically or travelling horizontally. Probably research on contra-rotating airscrews will help to shed a certain amount of light on this problem, although the two cases are not strictly comparable. The nearest approach to helicopter rotor conditions is presumably that of an ordinary aircraft driven by contra-rotating airscrews doing a violent sideslip. Another factor which enters into the efficiency of coaxial rotors (and coaxial airscrews for the matter of that) is the distance between the two.

Having visualised some of the main difficulties encountered with coaxial rotors, one can begin to see why a large proportion of experimenters have obtained their first practical experience with two rotors placed side by side. There the aerodynamic problems were relatively simple.

Quite evidently the most attractive solution of the helicopter problem is to be found in the single lifting rotor, provided means can be found for counteracting the torque reaction. Two ways of doing this come to mind at once. By using suitably shaped aerodynamic surfaces it should be possible to utilise the slipstream from the rotor for resisting the torque. This sounds a little like sitting in a basket and lifting oneself by the handle, but is not actually so. The other solution, which is the one adopted by Igor Sikorsky in America, is to use a second rotor running in a vertical plane. Since the torque of the main rotor varies according to flight conditions, it is obviously necessary to have this second rotor so arranged that its thrust can be varied at the will of the pilot, either by varying its speed or its pitch angle. The widest range of control will evidently be obtained by the former method.

If fixed aerofoil shapes can be devised which will exactly counteract the torque under all conditions, then obviously that is the simplest and neatest solution. If that is not possible, the use of the second rotor becomes necessary, as in the Sikorsky VS-300. This entails mechanical complication in the form of a variable-pitch mechanism, and also a certain amount of extra weight.

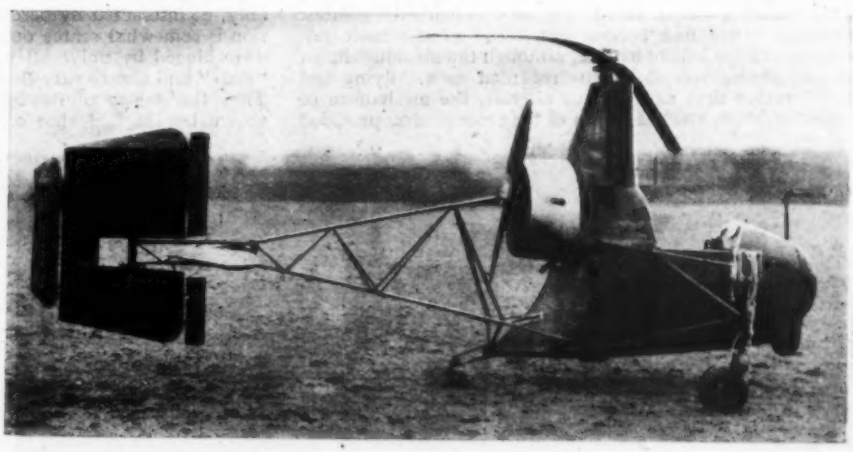
So much for the problem of torque reaction. There is still the question of lateral and fore-and-aft control. It is now generally held that these two controls can be achieved by means of the main rotor, either by tilting the head or by a variation in pitch angle of the blades. For stability certain other measures will probably have to be taken, such as fixed aerofoil surfaces in the vertical and horizontal planes.

In addition to the types of helicopter dealt with in the foregoing survey, there is the "paddle wheel" type with which experiments were carried out some years ago in Germany and the United States of America. In the latter (the Platt) the "paddles" were almost square, while in the Rohrbach they were of high aspect ratio.

The Rohrbach design is shown on this page. It will be seen that it comprised a normal type of fuselage with orthodox tail surfaces. The engine was housed centrally in the fuselage, and the wings were in the form of three high-aspect aerofoils on each side, carried on a cantilever shaft which ran right across from tip to tip and was carried in bearings on the fuselage. Drive was by worm or bevel gears. The torque reaction was counteracted by the pendulum weight of the fuselage, so that at greatest torque (that for vertical ascent) the tail was down some 6 deg. When gliding with power off, the nose was down about the same amount.

A Paddle Analogy

Older readers will probably remember the paddle steamers of their youth, in which the paddle blades had their angle changed on their way around the circle in such a way as to enter and leave the water "edge-on" while being at right angles to the water surface throughout their "power stroke." Something of the same sort was arranged in the Rohrbach paddle plane. At the top the blades had an angle of incidence of about 3 deg. At 90 deg., i.e., at the most forward point of their travel, they were set at an angle to give lift and thrust. At the bottom they were, of course, turned "on their backs," but still gave a little lift, and over the rear half the angle was reduced to give minimum drag. The cyclic change of angle was effected by cams or link mechanisms, and for control the angles could be changed differentially by the pilot to give lateral control as well as any desired slope of the resultant lift force.



In the Nagler Helicogyro were combined the gyroplane and the helicopter. The slipstream from the pusher airscrew impinged upon the "slotted" tail fin and so counteracted torque when the machine was flown as a helicopter.

ROTARY-WING AIRCRAFT

The wings of the Rohrbach helicopter projected 14ft. 6in. on each side of the fuselage. Maximum speed of the rotor was 420 r.p.m., which gave the blades a peripheral speed of about 170 m.p.h. At the top of the circle the blade speed was, of course, highest, since it had the aircraft speed added to its peripheral speed. The estimated top speed of the machine was about 120 m.p.h., so that at the top of the circle the blades were meeting the air at 290 m.p.h. or so. A freewheel was incorporated so that by setting the blade angles the pilot could ensure autorotation when the engine stopped. The machine was, so far as we know, never completed, possibly due to the fact that Rohrbach's concern had to go into liquidation.

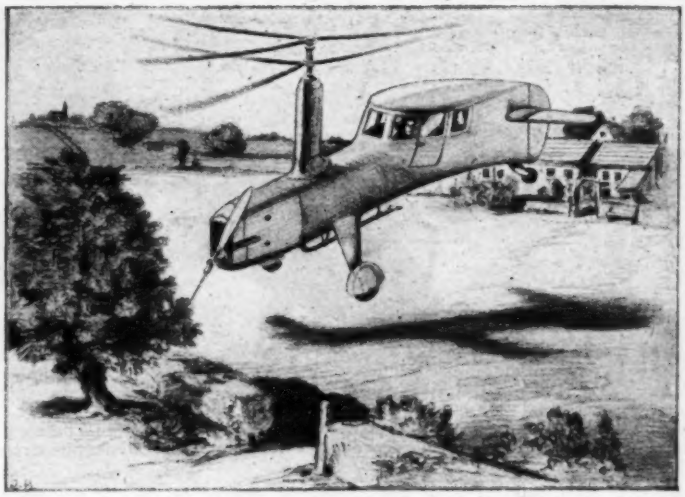
A Single-rotor Type

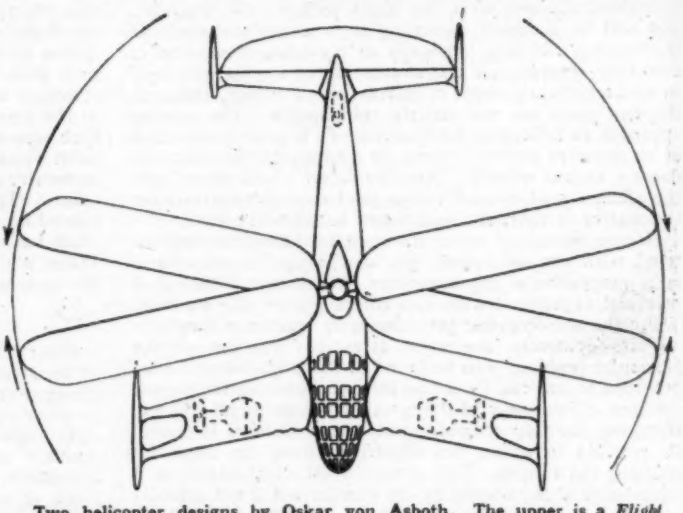
At about the time Dr. Rohrbach was developing his paddle plane in Germany there came to England two young Austrians, Nagler and Hafner, with designs and plans for a helicopter. For a time they established themselves at Heston, and one of our pictures shows their machine. It was of the single-rotor type, and it will be seen that torque reaction was counteracted by two wing-like surfaces placed on edge. The engine was a small Salmson air-cooled, and was of inadequate power, but the design taught the two young inventors a great deal. Ultimately Nagler and Hafner parted company, each going his own way. Nagler produced another machine, called the helicogyro, which was a combination of helicopter and gyroplane in that it could be flown either with the rotor driven or windmilling. A pusher engine was installed, and the single rotor was of the two-bladed type. The tail surfaces were arranged to counteract the torque of the driven rotor.

Herr Hafner (who has since become naturalised) formed his own firm, the A.R.111 Construction Co., and shelved helicopter work in favour of the gyroplane referred to in the first article in this series (March 25th, 1943). He did not, however, abandon work on the helicopter type, and some years ago he showed *Flight* the drawings of a very neat single-rotor machine in which the torque was counteracted by shaping the fuselage something like a wing "on edge." War interrupted progress for a time, but it is to be hoped that work will be resumed. The design was certainly promising.

In France it was M. Louis Breguet who made the greatest progress. He had become convinced of the basic advantages of the helicopter, and although the machine shown in our photograph should be regarded as a "flying test bed" rather than as a serious aircraft, the mechanism of the rotor head, and the action of the rotor blades, provided useful data for application later to a more practical machine.

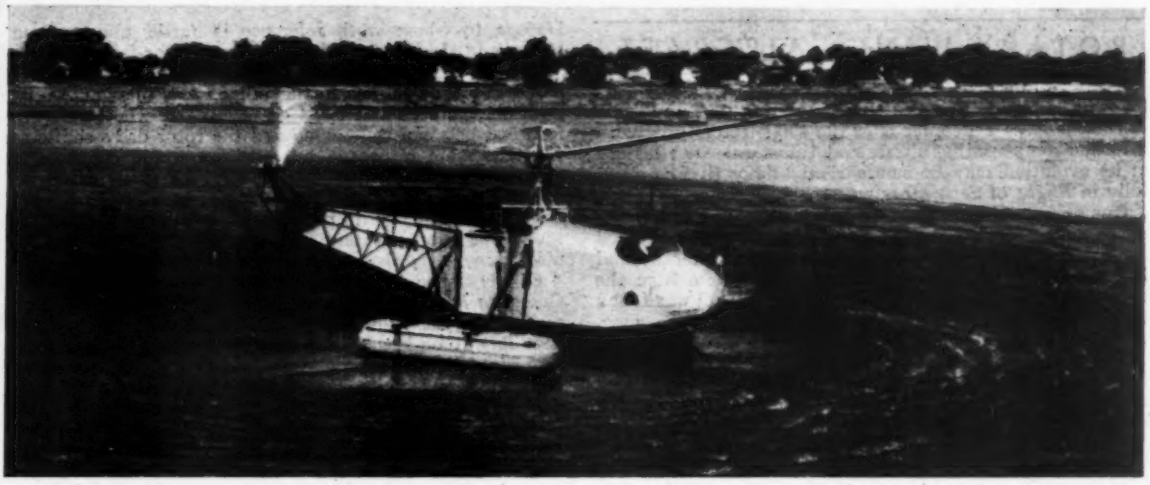
The Breguet helicopter, it will be seen, belonged to the coaxial twin-rotor class. Torque reaction was, presumably, counteracted by aerodynamic tail surfaces (information is somewhat scarce on that point). The rotor blades were hinged by universal joints so that they were free to "flap" and also to vary their spacing in a horizontal plane. That the degree of freedom was excessive seems to be shown by the fact that on one occasion the pilot, while making a turn, throttled down too much, with the result that centrifugal force was insufficient to hold the





Two helicopter designs by Oskar von Asboth. The upper is a *Flight* artist's impression of an earlier type. The plan view shows the machine that was being designed shortly before the outbreak of war. In this the tractor airscrew had disappeared.

In its earlier stages the Sikorsky VS-300 had four rotors, a main lifting rotor and three control rotors. This was simplified later (as shown in the picture on the next page) into two, the main rotor and an airscrew at the stern for countering torque and for directional control.



The Sikorsky VS-300 has just alighted on water and is supported by flotation bags. The airscrew at the stern gives directional control and counteracts the torque from the main rotor.

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blades out at the proper angle. An upper blade touched a lower and the machine crashed. But such was ever the fate of the pioneer. Control was achieved in the Breguet by varying the blade incidence. The Breguet helicopter made several flights, some in a straight line and some over closed circuits.

A German aircraft firm which has always been willing to experiment with new ideas is the Focke-Wulf Flugzeugbau, of Bremen. Many years ago the firm designed a tail-first, or *Ente*, type. The machine had many interesting features, but a crash in which its designer, Professor Wulf, was killed, led to the abandoning of work in that direction. Then came the Autogiro era, and the Focke-Wulf concern entered into an agreement with the Cierva Autogiro Co., Ltd., for licence rights. At the same time Professor Focke, the surviving partner in the firm, began to interest himself in the next step, pure helicopter flight. He realised that he would have to make full use of all the knowledge that existed at the time, and doubtless his agreement with Cierva was of considerable help. In fact, Professor Focke paid tribute to Cierva, and to such British aerodynamicists as Glauert and Lock, in an article we published in *Flight* of April 21st, 1938, in which he described some of the work on developing his FW 61 helicopter. Actually that machine was not built by Focke-Wulf, but by a subsidiary company, Focke, Achgelis and Co.

Side-by-side Rotors

Professor Focke, after examining the problem very carefully, came to the conclusion that the most satisfactory solution, at least for a start, lay in the twin-rotor arrangement, with the rotors placed side by side. Not only was torque reaction cancelled out, but each rotor worked in undisturbed air, and was thus more efficient. Moreover, the arrangement avoided the vibrations sometimes encountered with coaxial rotors.

The result was the FW 61, which established a series of world's records for helicopters. As a demonstration of the perfection of its controls it was flown *inside* the Deutschland Halle in Berlin by Fräulein Hanna Reitsch, who not only hovered stationary but flew slowly forwards and *backwards*.

Control of the rotors and complete machine was by tilting the rotor heads. The blades were hinged, as in the Cierva Autogiro, so as to be free to "flap," and, in addition, their incidence could be changed, but this change was used only for ensuring autorotation in case of engine failure, and not for flying control. A freewheel arrangement was, of course, incorporated in the drive. It is interesting to record in this connection that in this country also work has been going on with twin-rotor helicopters, the firm in question being J. and G. Weir, Ltd., of Glasgow. But that is another story.

One of the pioneers of helicopter design is the Hungarian engineer, Mr. Oskar von Asboth. As long ago as 1918 he had built a captive helicopter with which he succeeded in leaving the ground. Of his political vicissitudes we need not speak here. He came to England a few years before the outbreak of the present war, and by 1939 appeared to be in fair way to forge ahead, there being then some prospect of Air Ministry benevolence if not actual assistance.

The basic feature of the Asboth helicopter, type A.H. X, shown in plan view, is the type of rotor hub used. The inventor was in the habit of referring to it as a four-function hub. Actual details were not disclosed, but one of the three functions was control of the machine by tilting the planes in which the oppositely running rotors rotated. The other three functions were entirely automatic, including the change in pitch angle necessary to ensure autorotation.

Twisted Blades

From an aerodynamic point of view, the rotor blades were mainly interesting on account of their twisted incidence. They were, in fact, intermediate between the blades of an airscrew and the more orthodox untwisted blades of most gyroplanes. The inner ends, or roots, were at no angle of incidence. The middle portion had a small positive angle, and the tips a negative angle. Mr. von Asboth had calculated that this would give the best lift distribution, and consequently greatest efficiency. The arrangement had the further advantage that for autorotation the negative angles near the blade tips gave a powerful forward thrust and thus assisted autorotation in conditions when blades of the constant-angle type would slow down.

An unusual feature of the Asboth helicopter was that the blades were not hinged at the root. They were set rigidly at an upward angle which corresponded to the resultant force (of centrifugal force and lift) when the machine was hovering. During forward speed of the whole machine there was a residue of unbalance, but the rotor head and blades were designed to take care of that.

Finally we come to the Sikorsky VS-300 helicopter designed and built by the Vought-Sikorsky Division of the United Aircraft Corporation of America. Encouraged by the pioneer work on autogiros done by Senor de la Cierva, and materially assisted by the accumulated experience of Cierva and his associates, Igor Sikorsky began work (or more correctly resumed it, for he had worked on helicopters in Russia before the aeroplane was a practical proposition) on his helicopter in 1938. The first VS-300 was built the

ROTARY-WING AIRCRAFT

following year and flown extensively during 1940 and 1941.

The Sikorsky helicopter is of the single-rotor type, with a torque-compensating airscrew at the stern. The history of its evolution may be summarised briefly (it was given fully in *Flight* of September 3rd, 1942).

One experiment tried was to have the main rotor blades uncontrolled (except for the change in pitch angle needed for autorotation) and to control the machine laterally and fore-and-aft by two rotors carried on outriggers from the aft portion of the fuselage. This type of control was found to be very effective, but the transmission was, of course, complicated, and the outriggers offered a lot of drag.

The final step in the evolution was to introduce rotor head mechanism whereby the pitch angle could be changed throughout the 360 degrees of rotation so as to give both lateral and fore-and-aft control direct from the main rotor, this control being, of course, operated by the pilot. A second control was the pitch change of all three rotor blades (range +2 to +13 deg.) simultaneously for controlling ascent and descent. This control was interconnected with the throttle.

Originally the rotor had three blades, each of 14ft. span, but recently a two-bladed rotor has been tried. Raoul Hafner, to whose work reference is made above, is a believer in the low-solidity, high-speed rotor for efficiency, and both the Cierva and the Weir jump-start autogiros had two-bladed rotors. In the VS-300 transmission was by multiple vee belts and bevel gears. A free-wheel unit was installed between the engine and the rotor drive shafts so that the main rotor and tail airscrew would continue to turn in an autorotative condition in the event of engine failure. In hovering flight the main rotor of the VS-300 turned at about 260 r.p.m., while the speed of the tail airscrew was approximately 1,300 r.p.m. Control of the tail airscrew was by changing the pitch angle of its blades.

Of the particular Sikorsky helicopter which the British Government has ordered for anti-submarine work no information has been disclosed. It may be taken for granted that it will be larger than the VS-300 and have a more powerful engine, otherwise its range and load-carrying capacity would be inadequate for the work for which it is intended. It may be recollected that the VS-300 established a world's record for helicopters by remaining aloft for 1 hour 32 min. 26 sec. It is presumed that its useful load (apart from pilot) on that occasion was represented by the petrol used by the 90 h.p. Franklin air-cooled engine during that period. A substantial improvement will have to be effected before a helicopter could be regarded as a serious practical war weapon, even if used weaponless for reconnaissance only.

More R.A.F. Jubilee Greetings

From *Field Marshal Smuts*:—

"To the numerous messages of congratulations which the R.A.F. will receive on its jubilee, I wish to add mine as a very special one. For I can claim not only to have been present at its birth, but actually to be responsible for that auspicious event.

"In my minute to the War Cabinet in October, 1917, which led to such a striking result, I made a prediction of the future of air power, which at that time was considered wildly exaggerated, but which has proved to have fallen far short of the measure to which air power has attained in this war.

"The part played by the *Luftwaffe* in the conquest of Western Europe, including France, and by the R.A.F. and the American Air Force in the present bombing of Axis countries, shows that it is now a weapon second to none in the armoury of war. Its limits have not yet been reached, and it may become in many ways the most powerful of all.

"Whether for war or for peace, the air is the most spectacular mechanical advance for a hundred years. May the R.A.F. blast the way to victory and thereafter blaze the new trails to future world peace."

The Secretary of State, *Sir Archibald Sinclair*, replied:—

"Please accept my warmest thanks on behalf of the R.A.F. for your message of congratulation on its silver jubilee.

"Lines so full of inspiration and hope from one to whose prescience the R.A.F. so largely owes its birth will be especially valued.

"Like your memorable minute of October, 1917, your message will be cherished in the annals of the Royal Air Force."

From *Mr. A. F. Sidgreaves*, President of the S.B.A.C.:—

"On behalf of all those in Great Britain who take part in the design and production of aeroplanes for the Royal Air Force, I send you a message of affection, congratulation and pride. It is the rich reward of those who make the tools to know that they are handled to the eternal glory of their country by an Air Force which has compressed into twenty-five years a record of heroism and achievement unique in history."

In reply, *Sir Charles Portal* sent the following message:—

"I send you warmest thanks for the moving tribute to the Royal Air Force contained in your message of congratulation on our 25th Anniversary. We know full well that whatever we have been able to achieve has been made possible only by the genius of those who design our equipment and the skill and devotion of all who organise and execute its production. By sustaining us with an ever-increasing flow of weapons of the highest quality in design and workmanship and by the noble response of your factories to the calls of many special emergencies you have earned the deep gratitude and lasting confidence of all ranks of the R.A.F."

From the Russian Ambassador, *M. Maisky*:—

"Let me this day send you my warmest congratulations on the 25th anniversary of the Royal Air Force. It represents a new and powerful weapon of the war which has already played a very important rôle in the course of this great struggle, and it will play a still more important rôle in the final defeat of our common enemy.

"The Royal Air Force has glorious achievements to record in the past, the most outstanding of which is probably the Battle of Britain. I myself lived through those days and can bear witness to the exceptional courage, audacity and skill of your airmen. In the time of the great blitz, the development of your air force was still in its initial stages. To-day the Royal Air Force represents an immensely greater power than some three years ago. More and more it shows its mettle to the enemy—in Europe, in Africa, on sea and on land. The latest exploits in concentrated bombing of Germany, more particularly of Berlin and other great industrial and political centres, is the best example."

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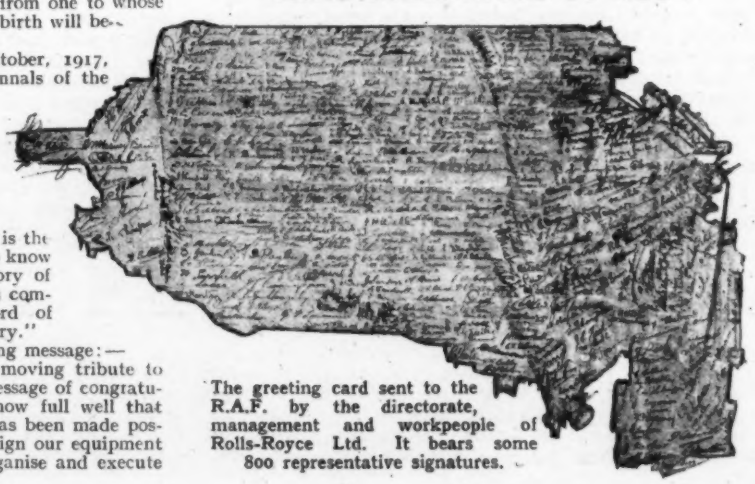

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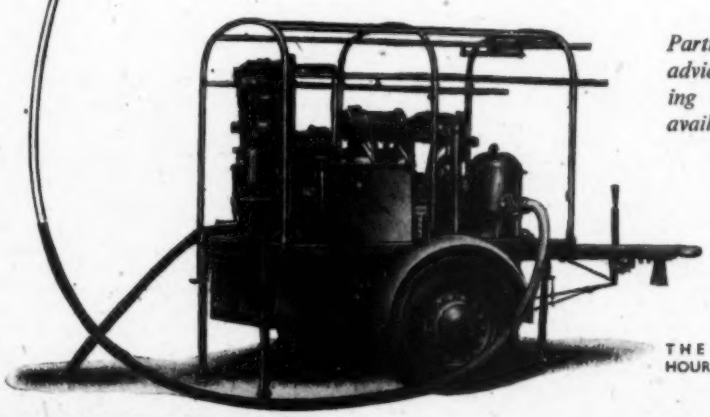

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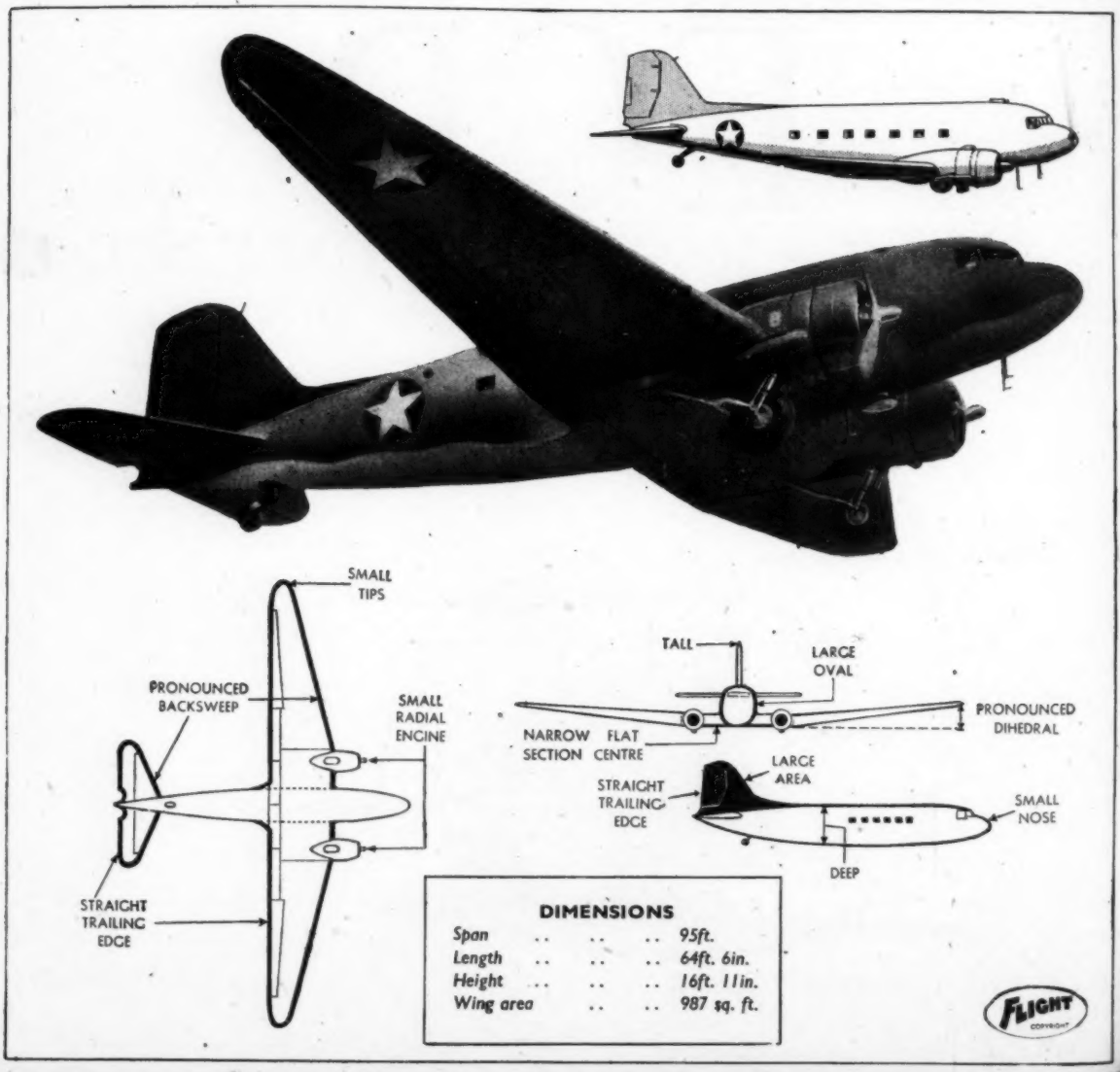
DOUGLAS DAKOTA.

IN the R.A.F. the military transport version of the Douglas DC-3 airliner is known as the Dakota; in America it has been named the Skytrain, but a senior officer of the U.S. Army Air Force in Great Britain recently told a member of *Flight* staff that they recognise it only as the C-47; they will have none of these pet names, not even those bestowed by their own people in America. Undoubtedly they are wise in adhering to their official military designations, but a name is surely easier to remember than a combination of letters and figures.

This variety of names and symbols by which even the most familiar type of American aircraft is known to different people in different places is rather an unnecessary complication. One feels it should have been possible to agree upon one name per aircraft, but this pleasant state of simplicity has not so far even been attempted, in spite of its obvious benefit in teaching the all-important subject of aircraft recognition to personnel of the Allied forces and Civil Defence Services.

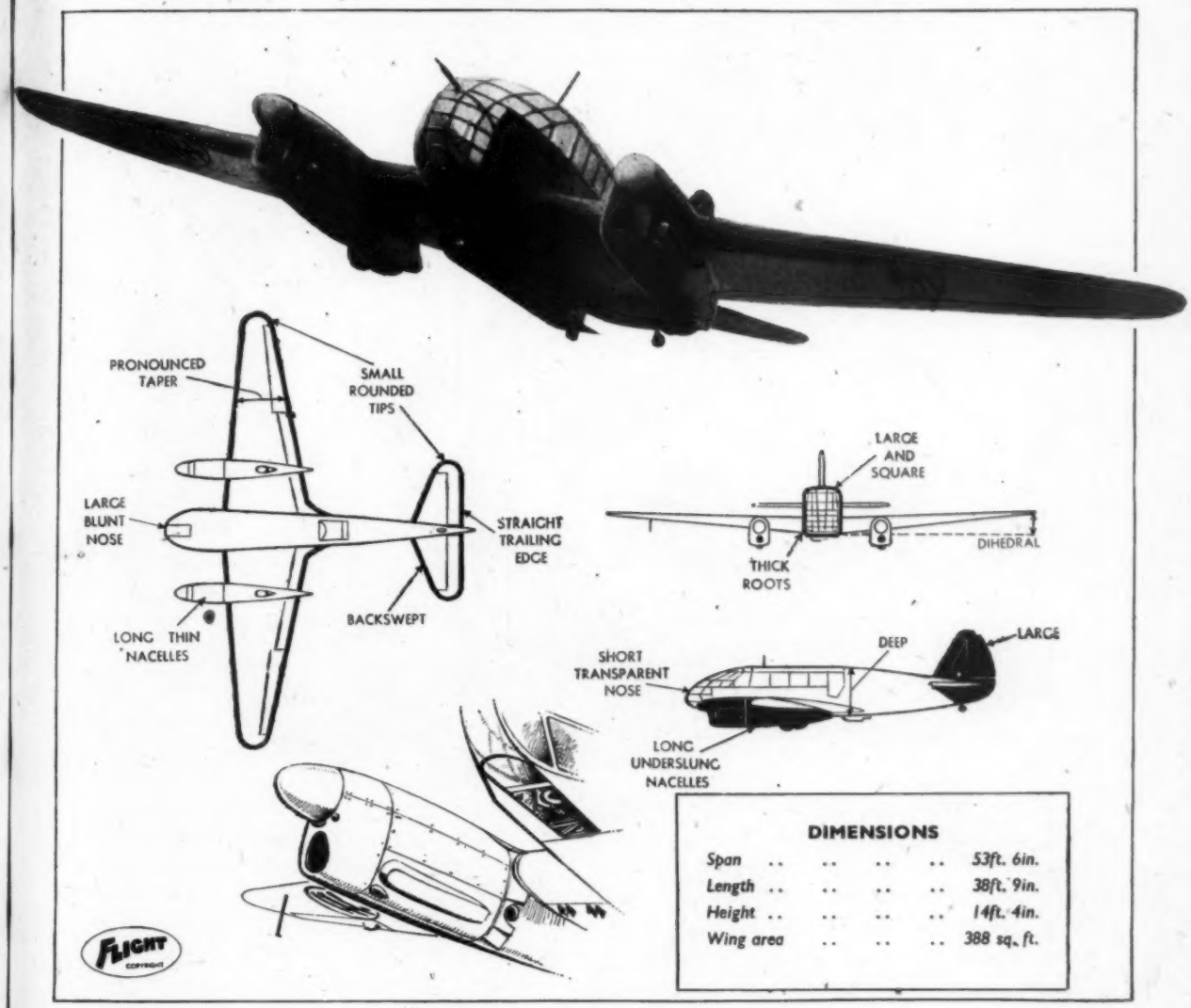
In its original form as a civil airliner, the DC-3 was certainly one of the most successful and efficient aircraft. It was in use on a wide variety of airlines all over the world, and no machine was better known unless it was its immediate predecessor, the DC-2, from which it was developed. To-day it is probably no exaggeration to say that it is the backbone of the U.S. Army air transport, and the R.A.F. have found it no less useful, while a number are being operated by British Overseas Airways both from this country and in the Middle East.

Powered by a pair of 1,050 h.p. Pratt & Whitney Twin-Wasp 14-cylinder air-cooled radial engines, the Dakota (or Skytrain, or C-47) has top speed of 230 m.p.h. at 8,500ft., cruises at 207 m.p.h. at 15,000ft., has a service ceiling of 23,200ft., and a maximum range at operating speed of 2,125 miles. It is of light alloy construction with Alclad stressed-skin covering, and has a gross weight of 25,200 lb., of which 8,750 lb. is useful load. The wings have a straight trailing-edge and a backswept leading-edge outboard of the rectangular centre-section, the tips being very small. The tailplane is similar in plan and the large single fin and rudder has a broad curved apex, a straight trailing-edge and a fairly large fillet on the root of the leading-edge.



d heir Characteristics

CAPRONI Ca 313



DIMENSIONS

Span	*53ft. 6in.*
Length	*38ft. 9in.*
Height	*14ft. 4in.*
Wing area	*388 sq. ft.*

ONE is apt to forget, these days, that there is still a *Regia Aeronautica*, but though it may not now constitute much more than an occasional slight nuisance to the air forces of the Allied Nations, it is not entirely inactive aerodynamically, and new types of Italian aircraft still appear from time to time.

One of the more recent additions to Benito's air force is the Caproni Ca 313, intended to fill the role of torpedo- or reconnaissance-bomber. This machine, a development of the Ca 311 light reconnaissance-bomber, extensively used in Africa (and Italy) during 1940 and 1941, made its bow about a year ago, but it is only lately that torpedo-bomber and coastal reconnaissance squadrons began to acquire it. It is, in fact, the third in a Caproni series of twin-engined bombers which approximate to our own Blenheims.

Apart from its in-line Isotta Fraschini engines, in fact, it bears a distinct resemblance to the Blenheim I, with its short, transparent nose and straight back. The wings, however, have far more taper and smaller tips than those of the Blenheim, while the tailplane plan is completely different from the familiar Bristol pattern. The single fin and rudder, however, are somewhat similar in shape to those of the Blenheim, except for the straight slope to the Caproni leading-edge.

The Isotta Fraschini engines are inverted air-cooled 12-cylinder "V" type "Delta" units, and it is worth noting that although their swept volume is almost the same as that of the Rolls-Royce Merlin (26.685 litres and 27 litres respectively) the Delta is rated at only 700 h.p., as compared with the 1,260 h.p. of the Merlin XX and the even greater output of the latest Merlin LXI.

The Ca 313 has a top speed of 248 m.p.h. at 11,480ft., and a service ceiling of 22,300ft. Its armament consists of two machine-guns in the leading-edge of the wing roots and fired by the pilot, one manually operated machine-gun in the nose operated by the bomb-aimer, and twin guns in a retractable dorsal turret just aft of the cabin. A single torpedo may be carried under the fuselage or the equivalent weight of bombs in external racks.

Said to have been intended mainly for attacks on British convoys sailing to Malta, the Ca 313 is reputed to have a range of about 1,250 miles.

ADHESION THROUGH THE AGES . . . . No. 2

THE RIVETER .... 1525. A laborious business the way they riveted then. But it was a sign of progress, another link in the chain of development of 'joining things together'.

Today that development has entered another vital stage — with the Bostik Adhesive System as its leading component. It is an age of adhesion. Obviously Bostik Adhesives and Sealing Compounds are complementary to many of the more conventional methods of 'joining things together' although in some instances they supersede those methods. But you know something of Bostik Products; you know from practical experience the extraordinary variety of 'jointings' that can be made with them. You are having many opportunities today to test out the qualities of certain grades, the variety of their applications. Remember all this when peace returns, whether you will be making planes, cars or lorries, canopies, furniture or footwear. Somewhere in the line of post-war production your experience of Bostik Products will serve you as well in peace as it does in war.

Here is the BOSTIK MAN *whom you know so well as representing the Bostik Technical Department.* After the war *he will still be at your service — to advise you personally on the application of Bostik Products to your particular problem of adhesion in* post-war industry.

THE **Bostik** SYSTEM OF ADHESION

B.B. Chemical Co. Ltd., Leicester

T.B.B.

Topics of the Day

By Way of Postscript

Some More Evidence in Favour of the Station Test Pilot Idea : Instrumental Ignorance : National Characteristics

SINCE making the suggestion on this page a few weeks ago that all stations should have their own resident test pilots I have heard of two quite outstanding examples where the existence of such a person would have saved a great deal of trouble and certainly a great deal of nerve wear and tear.

In one case the pilot of a bomber made a semi-forced landing on a "foreign" airfield at night, reporting that the directional trim was playing tricks and that he had had the greatest difficulty in keeping the machine straight. He was a very shaken man and obviously something of major interest had occurred. His story was simply that while carrying out searchlight co-operation, or something of the kind, he had been caught by the beams and had gone in for some fairly strenuous evasive action. Immediately afterwards he found the aircraft yawing almost uncontrollably. Thinking that something in the way of structural failure must be the cause, he forthwith took the aircraft to the nearest suitable landing ground.

On the following day riggers searched high and low for a possible cause of the trouble and found—nothing. The pilot flew it back to his unit in daylight and apparently without further incident. He may never know whether or not there was something curiously wrong which couldn't be discovered in an inevitably superficial examination, and he will always feel now that aircraft are curious beasts which do not follow the ordinary rules of mechanical behaviour. Both the aircraft and the man will now be suspect.

A resident test pilot, fit to fly all types, and thoroughly competent on all types, could have killed two birds with one stone. By repeating, so far as possible, the evasive manœuvres of the previous night, he could have satisfied both the engineer officer and the pilot that the machine was all right before it was taken back by the less experienced man, and he could have given the pilot a new lease of confidence before it was too late. If, on the other hand, there had been some peculiarity in the airframe, he would have found it and obtained enough evidence of different kinds to enable the riggers to get down to the business of rectifying the trouble. He would necessarily be taking some risks, but that would be his job, and he and his flight engineer would have a much better chance of coping with the trouble and landing safely—or even of baling out—than would a large and comparatively inexperienced crew.

Instruments all Haywire

In the second case the pilot of another and larger bomber found that his instruments had gone haywire in the middle of the night. Not unnaturally he parked the aircraft down at the nearest fully operational airfield and called it a night. The next day, as expected, it was found that one of the two vacuum pumps had packed up. The other was, apparently, delivering the goods. But the pilot said that he *had* switched over—the first and obvious action of any pilot when the gyros start to topple—without producing any appreciable effect. Maybe he did not give things time to warm up again, or maybe the second pump was not fully operational and the gyro speeds were too low for comfort.

An interesting point is that the rate of climb indicator was one of the instruments concerned, and this, as most pilots know, is a barometric and not a gyroscopic instrument. Its failure had no connection with the pump trouble, or with any trouble concerning the other instruments; though a fault at the static head might also have effected the sensitive altimeter and the A.S.I. It is possible that those three went haywire more or less at the same time as the pump; on switching over to the new vacuum supply the gyro instruments recovered, but the others remained at sixes and sevens. It's surprising how many quite knowledgeable flying people are still muddled about the sources of power and indication for the various instruments on the dashboard of an aircraft.

That last incident was not particularly important, and on the face of things it would have been a waste of petrol and time for the machine to have had an air test at the Station where it was landed. Furthermore, the pilot was not shaken. If he had been of the neurotic type it would have been well worth the fuel and the time to have shown him, by trial and error, exactly what had gone wrong before he returned to his own unit in a slightly happier frame of mind. Psychics are so very much more important than mere mechanics.

Feels "Funny Like"

I well remember an aircraft which was tested and tested because each pilot said that there was "something queer" about the fore-and-aft control. There was; after quite a few hours' flying it was accidentally discovered that the elevator horn balance was not only in a partly deconstructed condition but that one or two tools had been left inside when the fabric had been prematurely doped up. At all costs, the feeling that an aircraft is not "quite right" must be prevented from growing in the inexperienced pilot's mind. It is worth while to do any number of tests, either to find the cause of the trouble or to convince the pilot concerned that there really isn't anything the matter with X for Xenophon or M for Mothersill's Seasick Remedy.

And I repeat, *ad nauseum*, that funny sounds and queer handling characteristics cannot always be put down to mere "cockpit trouble." Admittedly, that trouble is common enough, but it nearly always has some more factual basis—if only in the body or mind of the pilot concerned—and should be looked into. At the risk of overstressing my point, I'll quote one more example of a peculiar trouble which, luckily, was nipped in the bud.

In this, a consistent roughness was noticed in the starboard engine of a twin-engined machine. Nothing to make a fuss about, and in the air there was no mag.-drop, ample boost and ample revs. The machine was only brought in when the oil pressure started to drop, though it remained just above danger level, and was not appreciably lower than that on some similar engines; the oil temperature was normal. After a great deal of fiddling, the sump was eventually removed, and some strange pieces of metal found therein. A sleeve had seized, and its connecting-rod, or what-not, had broken.

That engine was running happily, if a little roughly, on thirteen of the fourteen cylinders. No doubt it would have gone on flying for quite a while unnoticed, except as a casually remarked roughness, if the oil pressure hadn't dropped. There was no mag-drop, because neither plug had any work to do in that cylinder; the blower blew and there was no loss of boost; and the good c.s. unit kept the revolutions at the right figure. How *was* anybody to know? The ground revolutions were slightly affected because the c.s. unit couldn't quite make the grade with the reduced power in stiff static conditions, but that was all. The incident says a very great deal for the modern aircraft engine, though there was a very rare example of mechanical failure, the engine kept going, and would no doubt have kept going for quite a few hours.

By way of postscript to yet another article (on tail-

BY WAY OF POSTSCRIPT

wheels and nose wheels, and so forth), I must say that American legs, feet and ankles must be differently constructed if their pilots really prefer the pedal type of wheel brakes. On small machines the system is not too bad, but, after taxying half a mile on a big machine, particularly if it is a tricycle job with a continually veering nose wheel, my ankles and legs ache abominably.

In fact, the only reasonably comfortable way of dealing with a large aircraft is to lock the controls, so that the rudder, at least, stays put and leaves one's toes free to deal with the rocking pedals, which usually form an upward extension, so to speak, of the rudder pedals. With the rudder free I find that every time I try to apply the brake one way or another the pedal tends to rush away from me, and, in my efforts to apply the necessary pressure and to keep my feet where they should be, I'm actually applying more pressure on the opposite brake.

Maybe, one develops the right kind of ankle control in time, but I cannot believe that anyone who has tried both systems can possibly fail to think that the standard British idea of a single brake control on the column and differential action through the rudder movement is not the better one.

Feet were never trained to the job of exerting accurate pressures, least of all with the toes and heels separately, and it is very difficult indeed to apply the right amount of pressure to two separate pedals. Hence my often somewhat snake-like arrivals and departures on American aircraft.

As I say, one learns to do it, at great price in aches and pains, but I hope one day to fly a tricycle with a "conventional" braking system. Maybe I'm just conservative, and I should very much like to hear what American ferry and other pilots think of the merits of the two systems. Since most of them have done all their early flying on American types, and should have the pedal brake operation firmly embedded in their reactions and muscles, their opinion of our system should be interesting. Apart from detail layout in unimportant items, it is only in the braking system that American and British aircraft fail in their relative standardisation.

Faced with a beautifully designed American instrument panel, I bless, too, the person who thought out the "standard" blind-flying panel, which is still to be found in all British aircraft. There the instruments are all the same size and all in the same relative positions. INDICATOR.

Book Reviews

"Airwomen's Work." By Leonard Taylor. Pitman, 1s. 6d.

WRITTEN by the editor of the *A.T.C. Gazette*, this little booklet will give girls in the Women's Junior Corps and the Girls' Training Corps, for whom it is primarily intended, a good general idea of the various branches of work performed by members of the W.A.A.F., whose ranks they will in many cases wish to join later on.

Couched in the simplest of terms which any 12-year-old schoolgirl should be able to understand, it does not pretend to be either a syllabus of instruction or an encyclopædia of Air Force information; it is merely intended to arouse an interest in the fascinating subject of aviation with particular reference to the part now being played by women.

"Advanced Flying." By Capt. Norman Macmillan, M.C., A.F.C. Allen and Unwin. 2s. 6d.

A FUND of practical knowledge, based on some twenty-five years' experience in the art of handling all kinds of aircraft, is placed at the disposal of the pilot who has but recently acquired his wings. The author believes that it is advisable for pilots on graduating from elementary flying schools, to develop objective minds towards flying as soon as possible, and though a full appreciation of advanced flying technique can only be gained by personal experience in the air, this book will certainly provide a background of knowledge of what to do and what not to do which will rid the pilot's early development of many a disappointment and a certain amount of danger.

"They Flew Through Sand." By Sqn. Ldr. George W. Houghton. Jarrolds, Ltd. 6s. net.

SQN. LDR. HOUGHTON is a Press Officer, whose duty it is to be guide, philosopher and friend to war correspondents, and shepherd them about the front. In his case the front was the Western Desert. In the course of his wanderings he had many interesting experiences and saw many unusual sights. These he describes in this book in a delightfully chatty style.

He makes no attempt to tell the story of any one of the desert campaigns, and he does not describe the organisation of the R.A.F. or discuss tactics. What he does attempt to give, and succeeds very well in giving, is a picture of what our airmen in the desert had to do and dare, and the sort of life they lived. The title which he has chosen for his book is therefore very appropriate. One of the strange points which he brings out is how the men got to love the desert in a perverted sort of way. After some months of it they would long for a holiday in Cairo, with baths and other amenities of civilisation; but usually after a few days of Cairo they began to itch to get back to the desert.

This book is not a war history, but it makes very enjoyable reading.

"Pilot Officer Prune's Progress." By Anthony Armstrong. Pictured by Raff. Herbert Jenkins. 3s. 6d.

EVERYONE in the R.A.F. and many outside the Service are by now quite familiar with the character known as P/O. Prune; he is the dutiful but dumb boob who always does the wrong thing, and we cannot do better by way of explaining this book than to quote from the introduction which says, "Such outstanding ability to do the wrong thing at the wrong time in the wrong way has not, of course, been achieved in the mere twenty years of Percy Prune's life. Heredity has played its part. Generations of Prunes have lived, boobed and died before the sum total of their cosmic ineptitude could be concentrated in one single human frame . . ."

In the pages which follow, the "gallant but dim-brained pilot-officer" shoots a line about his family tree. "Over to you—ovah!"

"Tail Gunner." By Flt. Lt. R. C. Rivaz, D.F.C. Jarrolds, Ltd. 5s. net.

IF one tried to summarise this book in one word, that word would have to be "grim." It gives the most vivid accounts that we have ever read of what a bombing raid is really like to the air crews who take part in one. The author, an officer air-gunner, selects several of his experiences and describes them minutely. Throughout he recounts his own feelings with intimate detail. He was always keen to go on a raid, but before the raid started he always suffered painfully from what he calls "stage fright"; on the raid he suffered in turn from cold, boredom, fear, excitement, exultation, depression, and final reaction. Yet he was always able to enjoy the beautiful sights which he saw from the air, the countryside, sunset, moonlight, dawn, even the colours of the various sorts of *flak*. All his sensations are set forth frankly, and it would be small wonder if a reader, after finishing the book, found himself unable to sleep that night, as the author sometimes was before or after a raid.

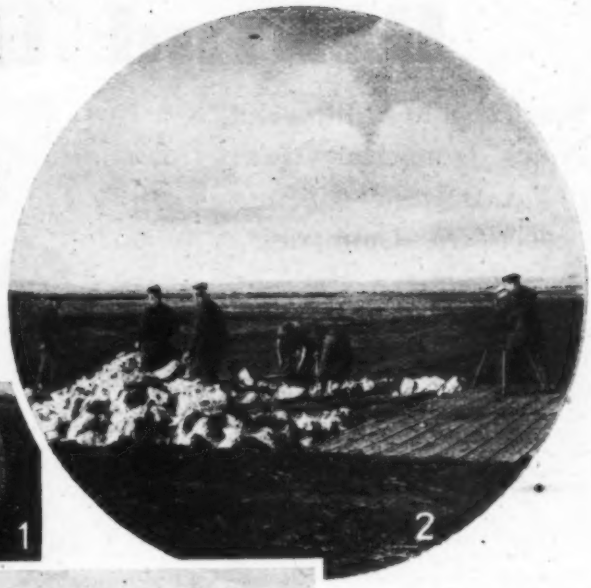
Twice the author's bomber was brought down on the sea, and once the crew had a very bad time indeed in the dinghy before they were rescued. Such an experience gives full opportunity for this author's power of describing sensations. He was in the daylight raid by Halifaxes and others on the *Scharnhorst* when she had fled to La Pallice. That time one of his crew was killed, and he shot down the fighter which had killed him. That raid has never before been so vividly described, and we feel sure that no better account will see the light in the future.

But, though this book is written from an intensely personal point of view, nobody could possibly accuse the author of being a "line-shooter." He never mentions the incident for which he was awarded the Distinguished Flying Cross.

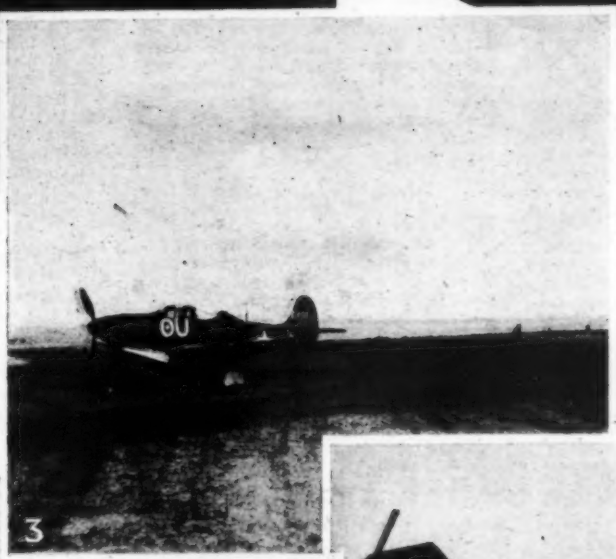
North African Runways

Wire and Matting Surfaces: Special Area for Lame Ducks

1. A motor grader at work levelling the runway site. This is only one of many types of specialised vehicles which an invading force must take with it.



2. Filling-in a depression with hard core. The man on the right is taking levels with a theodolite. A considerable supply of hard core is also kept handy to fill in the bottoms of bomb craters.



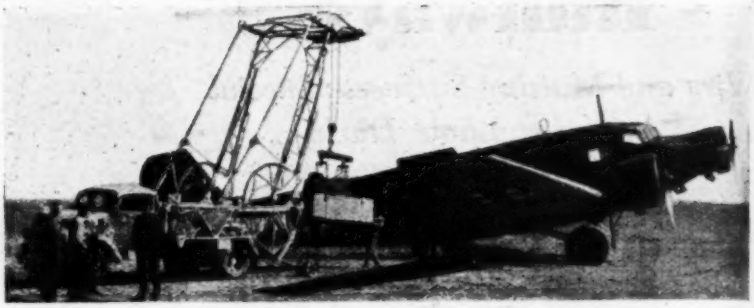
3. The landing section for damaged aircraft. On each side of the main runways these soft surfaces are specially prepared for "belly" landings.

4. The finished runway with the soft landing section in the background.

5. As the surface is prepared, coir matting is laid and covered by a wire netting and steel rod Somerfeld track. The matting beneath the track gives stability to the runway in wet weather and spreads the landing-wheel loads over a greater area of ground.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries



LUFTWAFFE MAINTENANCE: A truck equipped with a special crane loads spare engines on a Ju 52 for transport to advanced airfields

A German Lecturer

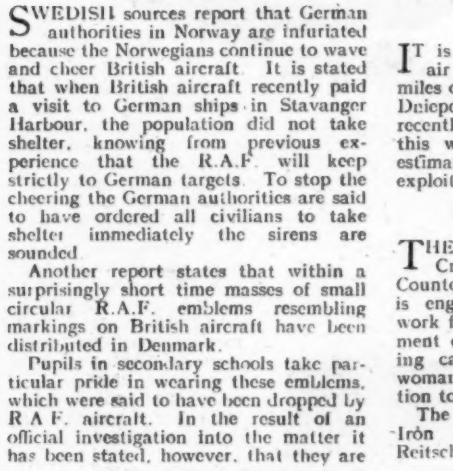
GENERAL LORENZ, of the *Luftwaffe*, has recently given a lecture in Madrid to the Chiefs of the Spanish Air Force on the subject of improvements in aviation during the present war. The lecture was accompanied by demonstrations of German films showing recent developments in aeronautical science.

R.A.F. Friends

SWEDISH sources report that German authorities in Norway are infuriated because the Norwegians continue to wave and cheer British aircraft. It is stated that when British aircraft recently paid a visit to German ships in Stavanger Harbour, the population did not take shelter, knowing from previous experience that the R.A.F. will keep strictly to German targets. To stop the cheering the German authorities are said to have ordered all civilians to take shelter immediately the sirens are sounded.

Another report states that within a surprisingly short time masses of small circular R.A.F. emblems resembling markings on British aircraft have been distributed in Denmark.

Pupils in secondary schools take particular pride in wearing these emblems, which were said to have been dropped by R.A.F. aircraft. In the result of an official investigation into the matter it has been stated, however, that they are manufactured " by irresponsible circles " in Denmark.



FOR THE MEDITERRANEAN: An Italian picture of the Savoia-Marchetti S.M. 84, described as the "Marsupiale," being loaded with a torpedo. The torpedo is carried inside the fuselage belly.

Air Survey

IT is reported from Germany that an air survey of about 190,000 square miles of forest in the region of the rivers Dnieper, Pripet, Desna and Beresina has recently been completed. The object of this work was to establish a correct estimate of trees to ensure a better exploitation of timber.

Iron Cross Ladies

THE Fuehrer has awarded the Iron Cross, Second Class, to Melitta Countess Schenk von Stauffenberg: who is engaged on development and test work for the *Luftwaffe*. The announcement of this award states that her flying career "is unusually long for a woman," and emphasises her contribution to the testing of German Stukas.

The only other woman awarded the Iron Cross is *Flugkapitaen* Hanna Reitsch, well known stunt flyer, who is also engaged at present as test pilot.

From Russia to Neutrality

LT.-GEN. MUNOZ GRANDE, Commander-in-Chief of the "Blue Division" of Spaniards employed by the Germans against Russia, has left the Eastern front to take up an appointment as Chief of the Military Cabinet of Gen. Franco.

Danish Gliding

UNDER the supervision of the Royal Danish Aeronautical Society and in co-operation with a leading Danish paper, the *Berlingske Tidende*, the first gliding course organised by the Danish Union of Glider Pilots is now being held.

The 25-hour course comprises the following subjects: materials, aerodynamics, navigation, meteorology, rules and regulations, and seven hours of flying.

All members of gliding clubs affiliated to the Danish gliding club are eligible, but the total number of participants of the course will not exceed 55. At the end of the course there will be a final test to qualify for the diploma in gliding of the Royal Danish Aeronautical Society, and successful pupils will receive, in addition, a certificate from the Directorate of Civil Aviation.

Jap Rubber

THE Japanese Ministry of Economics has taken over the control of the Japanese rubber industry. Three hundred and fifty-one firms were pooled together and made subject to the supervision of a newly established Government company.

Recruits for "Regia"

THE first batch of recruits of the 1923 class for the Italian Air Force will be called up by April 12th. Only men who receive the official card have to report immediately. Deferred for future call-ups are all those who can prove that they are in one of the following categories: Boarders of Catholic Institutes, graduates, university students, or holders of certificates or qualifications of higher grade intermediate schools; students registered for the present scholastic year in the final or last but one form of the higher-grade intermediate school; candidates intending to take up final examinations in the coming summer term, and, finally, residents abroad, in Albania or in the Italian possessions in the Aegean.

Jitters

THE Italian Broadcasting Service indignantly states that some time ago *Luftwaffe* soldiers, "evidently suffering from short-sightedness," fired at Sicilian fishermen returning to harbour in small fishing craft, mistaking them for the advanced guard of an Allied invasion fleet.

It is also reported that several *Luftwaffe* officers and men were killed or wounded in clashes with the local population.

In Parliament

Post-war Fate of Short Bros. Shares : No Provision for Their Return to Shareholders : Lord Sempill Attacks the S.B.A.C.

THE strong action taken by the Minister of Aircraft Production, Sir Stafford Cripps, in dealing with certain difficulties which had arisen at Short Brothers, has provoked a great deal of curiosity (not to say anxiety in certain quarters) as to what will happen to this company's shares after the war, and it was to be expected that the point would be raised in the House of Commons without much delay.

Another matter which has drawn considerable attention was Lord Sempill's outspoken attack, in the House of Lords, on the "magic circle" of the Society of British Aircraft Constructors. Referring to this group of eighteen firms as a "charmed circle of the elect—or what we know as the approved firms," Lord Sempill said that the policy of the Air Ministry and the Ministry of Aircraft Production had been to give preference to these firms from the standpoint of design and manufacture. There were, he added, some 224 firms outside this circle.

S.B.A.C. Reply

The S.B.A.C. has, not unnaturally, been moved to issue a statement in the form of a flat denial of Lord Sempill's allegation. This statement runs as follows:—

> Lord Sempill's statement in the House of Lords on Thursday is inaccurate.
>
> The Society of British Aircraft Constructors was constituted to forward the general well-being of the British aircraft industry as a whole, and the activities of the Society are directed solely to help in achieving the maximum quality and quantity of aircraft produced in British factories.
>
> Contrary to Lord Sempill's statement, every class of member of the Society has a vote in the management of the Society's affairs, and is represented on the Council of the Society.
>
> The Society is not, and never has been, a "ring." It has nothing to do with prices for aircraft, engines, or any item of aircraft equipment, nor with the allocation of orders, nor the control of output. It cannot, and has never attempted to, interfere with the placing of orders or specifications with firms whether or not they are members of the Society. The Ministry of Aircraft Production places orders with any concern it chooses irrespective of whether it be a member of the Society or not.
>
> The knowledge and experience of the individual members of the Society have always been placed at the disposal of "shadow" and fringe firms brought in to meet the requirements of the aircraft production programmes, and these have received the greatest possible help in the solution of their problems.

A question as to what were the activities of the S.B.A.C. was subsequently put to Sir Stafford Cripps by Mr. Purbrick (Walton, U.), who also wanted to know how far it was the practice of the M.A.P. to confine itself to placing orders with members of the Society.

Sir S. Cripps: The Society of British Aircraft Constructors is an association whose primary object is to assist its members and co-ordinate their activities. Apart from representing the main body of the aircraft industry in its relations with the Government, the principal activities of the Society at the present time are concerned with some dozen technical committees, which they have set up to assist in the promotion of aircraft production both in quality and quantity. It is not the practice of my Department to confine orders for aircraft to members of the Society.

The subject of the Government's acquisition of the shares of Short Brothers was raised by Mr. W. Astor (Fulham E., U.), who wanted to know what steps the Minister of Aircraft Production was taking to ensure that the shareholders received their shares back at the end of the war, while Major Lloyd asked Sir Stafford Cripps if it was intended immediately after the war to restore to the firm of Short Brothers their full rights of ownership and private enterprise, recently taken from them.

D.R. 78 Provisions

Sir S. Cripps: The shares of Short Brothers were acquired by me under the provisions of the Defence Regulation No. 78. This Regulation provides that, if it appears to the competent authority expedient that all the shares in the company should be held on behalf of that authority the competent authority may by order made with the consent of the Treasury transfer the shares of the company to his specified nominees. The Regulation contains no provision for the return of the shares to the shareholders at the end of the war or at any other time, but provides that the shares so transferred shall vest in the transferees free from any mortgage, pledge or charge.

The price to be paid for the shares is to be fixed as between a willing buyer and willing seller, and there is no provision whereby that price can be varied as a result of any special condition attached to the transfer of the shares. It would not, therefore, be competent or proper for me to take any steps to ensure the return of the shares to the shareholders after the war.

The policy of the Government at the end of the war as to the disposal of shares acquired by them under the Defence Regulations will fall to be decided in the light of the circumstances then ruling. There is nothing in the existing position as I have stated it which would preclude the Government of the day, should it so decide, from making some fresh provision as to the repurchase of shares by the original shareholders in companies dealt with under the Regulation.

Nationalisation

Mr. Astor: Is the Minister aware that while nobody wants to hamper his work in dealing with a purely temporary wartime difficulty, there is the gravest disquiet at the thought that he may be trying permanently to nationalise civil aircraft. [*Interruption*]; and is it right to use a purely temporary difficulty in production to make a permanent change by the back door?

Sir S. Cripps: I am afraid that I am limited by what Parliament has decided, and I can only act within the ambit of Parliament's decision.

Major Lloyd: Does my right hon. and learned Friend realise that while very large numbers of people are not taking any exception to what he has done, they view with the greatest concern his reply to-day to this question, because of the precedent which it is setting? Will he not be able to give a greater assurance to the House that what individual firms are sacrificing in the national interest during the war, and all the sacrifices for freedom which they are making, will be restored to them after the war?

Sir S. Cripps: I am afraid that Parliament has decided the steps which should be taken in such cases as the present, and unless other and new decisions are taken, I must operate within the ambit of these Regulations.

Mr. A. Edwards: May we take it that the price which is paid as between a willing buyer and a willing seller will not be more than the price quoted on the Stock Exchange on the day this firm was taken over? Will the right hon. and learned Gentleman bear in mind that in the case of a previous transaction the country paid much more than that?

Sir S. Cripps: I do not of course decide the price. In the event of dispute, that is decided by arbitration. That has not taken place.

Mr. Edwards: Will the Minister bear

IN PARLIAMENT

in mind that much of the capital is watered capital?

Mr. James Griffiths: Is my right hon. and learned Friend aware that the action of the Ministry in dealing with vested interests has had a heartening effect on production all over the country?

Sir Irving Albery: Arising from the Minister's reply to the effect that these shares would be vested in the Government, free of all mortgage or charge, how is it proposed to deal with the bank loans of over £1,500,000? Are these to be paid off by His Majesty's Government? Secondly, will he say whether the main reason for taking over the shares of this company was a financial consideration?

Sir S. Cripps: The answer to the second part of the hon. Member's supplementary question is in the negative. So far as the first part of his question is concerned, I should have to have notice of that.

Mr. Lipson asked the Minister of Aircraft Production why he has found it necessary to take over the whole share capital of Short Brothers; will the concern be restored to private ownership after the war; and will the existing shareholders be given the option to repurchase?

Sir S. Cripps: As regards the first part of the question, it was in my opinion necessary for the purpose of securing effective control of the undertaking that all shares of the company should be held on my behalf. As regards the second and third parts of the question, I would refer the hon. Member to the reply already given to the hon. Member for East Fulham (Mr. Astor).

Mr. Lipson: Arising out of the answer to the first part of the question, may I ask the Minister whether he does not consider he could have attained the objects he had in mind by requisitioning the company at an agreed rental without taking over the share capital?

Sir S. Cripps: No; I am quite convinced that that method would not conceivably have worked in this case.

Mr. Lipson: In view of the importance of this matter, can the Minister give the reason why this method would have broken down compared with the method he has chosen, in view of the controversy which has arisen?

Sir S. Cripps: The power as regards requisitioning does not extend to the business, but only to the physical assets, and it is not possible to take over the physical assets without taking over the business.

Here and There

V.P. Propellers at Sea

OCEAN-GOING vessels of large size are now being fitted with variable-pitch propellers. Swedish and British patents cover such devices.

This is a case of aircraft design pointing the way.

U.S. Production Down

WHEN urging the mobilisation of all men and women for the war effort, Mr. Patterson, U.S. Under-Secretary for War, revealed that last month the 5,500 aircraft produced was 500 below schedule.

Airgraphs to New Zealand

AIRGRAPH letters addressed to New Zealand, Fiji, Tonga and the New Hebrides are now being accepted.

The charge for Airgraph letters addressed to personnel of H.M. Forces and of the Merchant Navy is 3d., and for those addressed to civilians 8d.

Premier's Honorary Wings

AS one who has piloted his country through the darkest days of the war, and will, as we all hope and believe, continue in control until victory is achieved, none could be more deserving than is Mr. Winston Churchill of the privilege of wearing the flying badge of the R.A.F. recently awarded him by the Air Council.

That it is indeed a privilege the Premier was himself the first to acknowledge, for none outside the Royal Family has ever before been awarded the wings of an R.A.F. pilot without first qualifying for this distinction in accordance with the exacting demands of the Service.

Air Mail Service to Sweden

THE Postmaster-General announces that the air postage rate on correspondence for Sweden has been reduced to 8d. for the first ounce and 5d. for each additional ounce in the case of letters and to 4d. for postcards.

The surface mail service to Sweden is still suspended.

Thanks!

MANY letters in appreciation of the R.A.F. number of *Flight* have been received from readers.

Rhyl Looks Ahead

PROVISION of a new pier with a landing roof for aircraft is among the proposed attractions included in a £1,000,000 scheme now being worked out at Rhyl with the object of increasing the town's amenities as a holiday resort after the war.

The report says that the pier will have three or four storeys, but no mention is made of the proposed dimensions of its roof-top airport. However, as the whole scheme will take nearly 25 years to complete, no doubt long runways for very large aircraft will be a thing of the past by the time the pier airport actually comes into use.

American's Gift to R.A.F. Benevolent Fund

MR. ALLAN MILLER, an American citizen who has lived in this country for the past ten years, has made a generous gift of £20,000 to the Royal Air Force Benevolent Fund in appreciation of the great services the men of the R.A.F. have rendered us all.

During the last war Mr. Miller served as a pilot in the Royal Flying Corps and the Royal Air Force.

End of Cardington Airship Mast

THE airship mooring mast at Cardington R.A.F. station is to be dismantled, and the 350 tons of high-quality steel salvaged will be turned into tanks. The mast, which is 210ft. high, has been a landmark since 1926.

The danger to underground cables prevented the salvage contractors from crashing the mast to the ground, and consequently it will take ten men three months to complete the task of dismantling it.

German Production Falling

ACCORDING to a report from Sweden, Germany's warplane production, excluding training machines, has dropped from the maximum of 3,000 to 2,000 monthly in the past year. Inexperienced labour, employed as a result of the manpower shortage, is largely responsible for this reduction.

More U.S. Day Raids

BRIG.-GEN. NEWTON LONGFELLOW, the Commanding General, in a recent letter to officers and men of the U.S. Army Eighth Air Force Bomber Command, said that between November 1st and March 20th the Americans dropped 4,000 tons of bombs on various enemy targets during 28 daylight raids carried out in spite of poor weather.

He went on to say that in the near future it is hoped to have enough forces to make daylight raids comparable with those now made by the R.A.F. during the night.

Exile's Overture

UMBERTO NOBILE, the well-known Italian explorer and airman, who apparently is not on too good terms with Mussolini, is now staying in Spain. Umberto Nobile, whose liberal ideas and long sojourn in Russia made him unpopular with the Fascist régime, appears to have arrived in Spain from the United States.

Speaking recently from Madrid Broadcasting Station, he said that he was going to stay in Spain for a long time to study the country and to take advantage of Spanish hospitality.

"In this Europe tortured by war," he added, "Spain is an oasis of prosperity in all spheres, and is destined to have one of the highest posts in the new Europe."

Presumably this was an overture to Italy's Dictator, as he wished for a *rapprochement* between the two great Latin countries.

Notes from a Test Pilot's Diary—No. 3

Boost Leaks

Tracing Three Principal Sources—In Connection to Supercharger Casing, in Boost Line, and in Boost Gauge

By "WITNESS"

AUTOMATIC boost control as applied to British aircraft engines has been one of our greatest assets in military aircraft, by safeguarding the engine against the inexperienced pilot. In testing, the boost-control unit introduces new problems, some of them not easily explained, but the major one is to decide whether loss of indicated boost is due to a leak or to some fault in the control itself. For if a sub-normal boost which is really due to a leak is treated merely by screwing up the adjustment on the boost-control unit, the effect will be to damage the engine by raising the boost in the engine above the permitted maximum, although the gauge reading becomes normal at low altitudes. Therefore, the subject of boost leaks deserves careful attention by the test pilot.

There are three principal sources of boost leaks: in the connection of the boost line to the supercharger casing; in the boost line itself; and finally in the boost gauge. Of these the first is undoubtedly the most difficult to locate, for unless the engine maker has made special provision for the purpose, the connection cannot be pressurised with a test rig. The only means available are trial and error, making and remaking the joint until flight results prove that the leak is cured.

Vibration Effect

On the other hand, the boost line itself, and the gauge, can easily be checked under pressure on the ground. In doing this it should be remembered that there are two additional conditions in flight: one the vibration of the airframe and the other the reduced density of the outside air. Both of these are adverse from the point of view of leaks. Vibration may open up a joint or obscure crack, and the reduced outside air density increases the differential pressure on the system. Fortunately, vibration is the less serious enemy, as it cannot conveniently be reproduced by a ground-rig, whereas differential pressure can, merely by increasing the test pressure.

For instance, if an engine is rated at 6½ lb. boost at 20,000ft., a fair test of the line and gauge can be made at 6½ lb., plus the difference between ground pressure (14.7) and that at 20,000ft. (6.7), making a total of 14½ lb. It is not always easy to explain to an inspector why a gauge which only reads 6½ lb. in the air should have to be blown up to 14½ lb. on the ground, and I have even known of boost gauges being tested surreptitiously by being blown up to 12 lb. or so and immersed in a bucket of water whilst the inspection staff were at their lunch!

In another case it was necessary to take an inspector to 15,000ft. in a bomber so that he could test half a dozen gauges under reduced density conditions and so demonstrate to his own satisfaction that gauges which held 6 lb. at ground level did not always do so at altitude.

The type of boost gauge used a few years ago was particularly susceptible to leaks at the face joint because the face had to be unscrewed to set the maximum boost indicator pip. This pip is really redundant and is a legacy of the old days before boost control was introduced, and the pilot had to be careful not to push his throttle beyond the point when the pip was reached on the boost gauge.

These same conditions, however, can be reproduced to-day on engines fitted with a boost-control cut-out, which allows the pilot a direct throttle. Fortunately, our main fighter engine, the Merlin, has been so highly developed that it will stand an extraordinary amount of flying at boosts beyond the pip, although theoretically that is the engine's limit. In the case of most foreign engines, the effect of overboosting is disastrous and immediate.

Face Leaks

With the type of boost gauge used nowadays, the "maximum boost" pip is on a floating ring which can be located circumferentially at any desired position by a small grub screw. There is thus no need to disturb the face joint in order to set the pip at 6 lb., or whatever the maximum permitted for full-throttle level flight may be. This design has substantially reduced the number of face-leaks occasioned in flight, but they still occur occasionally. The easiest way to check them is to press on the face of the gauge as soon as the boost begins to fall, and if this produces an increase of boost, it may be possible to overcome the leak by screwing up the face of the gauge in flight.

The fitting of a boost-control cut-out is a great help for deciding the reason for lack of boost at Rated Height (the height when maximum permitted boost is obtained on the climb with the throttle butterflies fully open) or at the Maximum Power Altitude (the height at which maximum permitted boost is obtained in level flight with the throttle butterflies fully open). If the boost becomes normal with the cut-out pulled, then one can be certain that there is no leak, but that the mechanism has prevented the butterflies from being opened fully. When there is no cut-out, the problem is much less easily settled, but an indication of sticking may be given by snatching the throttle open several times at M.P.A., or by diving from M.P.A. In the first case a variation in boost will indicate sticking boost control, and in the lafter the boost will rise in the dive above the maximum permitted.

OH, O/400!

A RATHER unaccountable slip of the Editorial memory caused the statement in last week's issue that the Handley Page o/400 was finished too late to make the contemplated raids on Berlin in the last war. Actually; of course, the o/400 was never intended for raiding Berlin; it had not the range. The type built for this purpose was the V/1500, which was a much larger aircraft (30,000 lb. loaded weight instead of 14,000 lb.), and was the first four-engined bomber to be built during the last war. After the war one of these machines, piloted by Sqn. Ldr. McLaren, flew to India, and later made a raid on Kabul. The o/400 was used extensively in the last war, first by the Royal Naval Air Service and later by the Royal Flying Corps.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

SPEED OF THE S.6B

How Much was Lost by Float Drag ?

HAVING read some of your readers' replies to Mr. C. G. Willey's questions, I should like to know the approximate speed lost due to drag of the floats on the Supermarine S.6B Schneider machine.

So far none of your correspondents has referred to this loss of speed.

R. J. MORRIS.

THE BEST TYPES OF AIRCRAFT

Thunderbolt versus Spitfire IX

MAY I add my comments to the attempts to rank leading designs? As the Mustang is the only low-level Army Co-operation machine of its type, why call it the best?

I agree with Mr. R. E. Gregory that there is no good high-altitude bomber-reconnaissance, but I cannot consider at all the opinion of "Squita" that the Thunderbolt is superior to the Spitfire IX.

Then Mr. C. C. Davidson displaces the Barracuda because we have no details. On this basis the Seafire is not as yet to be challenged by the Corsair. There seems to be a variety of opinions regarding the best medium and land-based torpedo bombers. I would say the Marauder in each case.

E. WATTS.

A Collective Vote

I ENCLOSE a list of aircraft supreme in their particular duties. This list was compiled by the members and associate members of Spotters' Club No. 182 (Dorking A.T.C.) and will, I hope, be more eligible for publication because it comprises the views of many keen spotters. In most classes, several aircraft were nominated, and some of the more surprising results, e.g., the land dive-bomber, may be attributable to their opponents having split the vote. In each class, each member had one vote, which he was not compelled to use. All aircraft whose names were still secret were excluded.

The correspondence in *Flight* on this subject has aroused much interest in this squadron, and the instructors are very keen on this controversy, since it is held that to have one's own opinions on a subject of this sort is a considerable aid to aircraft recognition.

Your "Aircraft Types and Their Characteristics" series is also highly thought of, and the appearance of a book containing all these features is welcome.

(This is the list compiled by vote by Spotters' Club No. 182 (Dorking A.T.C.))

High Altitude Fighter	Spitfire IX
Low " "	Typhoon
Interceptor "	C.W.21 B
Long Range "	Mosquito
" " " Bomber	Me.210
Short " " "	Fw 190
Light Bomber Reconnaissance	Mosquito
Medium "	Do 217 E
Heavy " (Day and Night)	Lancaster
Ground Strafer	Mustang
Army Co-operation	Mustang
Transport Landplane	Constellation
" Seaplane	Mars
Sea Fighter	Seafire
Sea Torpedo-Plane	Avenger
Sea Dive Bomber	Helldiver
Land "	Ju 88
Land Torpedo-Plane	Beaufighter
Navy Patrol	Sunderland

"Interceptor Fighter" was interpreted in the narrow sense of a light, fast, hard-climbing, short-range fighter, designed to take off when the enemy were near the coast and attack swiftly. The Curtiss-Wright C.W. 21 is obviously supreme in this class. The Mosquito had a narrow victory over the Beaufighter for long-range fighter, as did the Lancaster over the Flying Fortress for heavy day-bomber, this loss for the American being due to its low bomb load. The Barracuda lost the Navy torpedo-plane honours to the Avenger, possibly because the true facts concerning it were not known to all the voters. The Ju 88 had a slight majority over the A. 25 Helldiver and the Do 217E, and the Beaufighter had much competition from other land-based torpedo-planes, mostly British.

WM. FIRTH.

Fire Power in lb./min.

WE are most interested in Ex-R.F.C.'s list of what he considers are the best aircraft in each class in the world, and the other readers' suggestions that have followed it. Nevertheless, we feel that "Squita" should not give the title of "corny" to the Spit's armament, but to himself. How does he view the *fact* that the eight 0.5in. machine-guns give in fire-power only 480 lb./min. compared with the 575 lb./min. of the Spitfire IX C? His statement that the Thunderbolt is superior to the Spitfire IX is obvious proof of his complete ignorance of the subject.

The Spitfire is more manœuvrable, has as high a ceiling, is easier to produce, is faster and is more economical than the Thunderbolt.

Our list of the leading aircraft is as follows:—

Operational Class.	Aircraft type.	Nationality.	Second.
Single-seat Fighter	Fw 190	German	Spitfire V
Interceptor	Typhoon	British	—
High Altitude Fighter	Spitfire IX	British	Thunderbolt
Light Recco. Day and Night Fighter	Mosquito	British	Beaufighter
All-purpose Fighter-Bomber	Typhoon	British	Hurricane
Long Range Fighter-Bomber	Me 210	German	Havoc II
Long Range Light Recco. Bomber	Mosquito	British	Me 210
Medium Bomber	Do217 E2	German	Mitchell
Heavy Bomber	Lancaster	British	Stirling
High Altitude Light Bomber/Recco.	Ju 86P	German	Fortress
Army Co-operation	Mustang	American	—
Naval Fighter	Seafire	British	Corsair
Land-based Torpedo-Bomber	Beaufighter	British	He III HaE
Naval Torpedo-Bomber	Avenger	American	—
Naval Dive Bomber	SB2C-I Helldiver	American	Aichi K-99
Long Range Sea Patrol	Sunderland II	British	Coronado
Transport Landplane	Constellation	American	York
Transport Flying Boat	Short "G" Class	British	Boeing Clipper

R. M. DYE,
A. T. HENSHAW.

A New List and an Analysis

HERE is yet another "attempt to rank leading designs":

Type	Aircraft	Nationality
Single-seat fighter	Typhoon	British
Interceptor	Typhoon	"
High altitude fighter	Spitfire IX	"
Long-range day and night fighter	Mosquito	"
All purposes fighter-bomber	Typhoon	"
Long-range do.	Mosquito	"
Long-range recco-bomber	Mosquito	"
Medium bomber	Do. 217e	German
Heavy bomber	Lancaster	British
High altitude recco-bomber	Ju. 86p.	German
Army Co-op. fighter scout	Mustang	U.S.
Naval fighter	Seafire	British
Land based torpedo-bomber	Beaufighter	"
Naval do.	Barracuda	"
"Anti-Surface-Craft" dive-bomber	Helldiver	U.S.
Transport land plane	York	British
Transport flying-boat	Mars	U.S.
Transport glider	Horsa	British
Ocean patrol, land-based	Liberator III	U.S.
Do. sea-based	Sunderland	British

In spite of "Squita's" opinion to the contrary, I think the Spitfire IX is superior to the Thunderbolt at high altitudes in all but armament. The Spitfire IX *has* a higher ceiling, is more manœuvrable, and easier to handle—especially at heights above 35,000ft. or thereby. I, too, am a 0.500 m.g. enthusiast, and regret its absence over here—especially in the Spitfire.

If, as C. C. Davidson suggests, Typhoons *are* equipped with bombs, they will replace the Hurricane in this class. I think the Hurricane is better than the Fw190 as a fighter-bomber; its bomb-load is about twice that of Fw190, and 340 m.p.h. is just about fast enough for flying at "o" ft.

It has not, as far as I know, been officially stated that there is a version of the Mosquito carrying *both* bombs and an offensive armament, but from recent Malta communiqués it

CORRESPONDENCE

seems likely. Should no such plane exist, substitute Me210 as long-range fighter-bomber.

Latest figures give the bomb-loads of the Baltimore, Mitchell, and Ventura as 2,000 lb., and of the Marauder 2,460 lb. Only the last named exceeds the Mosquito's 2,000 lb. So, in my opinion, you just *can't* call the Mitchell, etc., medium bombers simply because they risk about twice the number of human lives per trip, cost about twice as much to build in the first place, and are bigger all over. The net result of 2,000 lb. of bombs from a Mitchell is the same as of 2,000 lb. dropped from a Mosquito. Either call them all light bombers and give the Mosquito class prize, or put them in a class of their own.

What a pity we didn't think of making this special Army Co-op. class when the Spitfire III was on the go! The Spit. III did 407 m.p.h. at sea-level with two cannon and four m.g.s, which would have made it one up on the Mustang, with its 370 m.p.h. and eight m.g.s.

The Seafire, with the same speed as the Corsair, does drop a point in its armament, but four cannon would more than even things up. The Seafire gains a lot on flying characteristics and also (of vital importance on a.c.s) stowage, deck handling, and maintenance qualities.

The Beaufighter is surely better than the Hampden or Marauder as a land-based torpedo-bomber. Lord Beaverbrook announced its use as such in the House of Lords recently.

Judgment on the Avenger *v.* Barracuda should probably be withheld until we can all study the figures of the Barracuda, but I think she will win on points.

The only rival for the York is the Constellation, which is not yet in service in numbers, nor is it likely to be for some time.

The only dive-bomber in my list, I've designated "Anti-Surface Craft" dive-bomber. In my opinion that is the one and only use for dive-bombers. Every other job you like to set them can be performed much more efficiently by fighter-bombers or light bombers. Even for ship sinking I'm beginning to have my doubts. In annihilating the Jap convoy in the Bismarck Sea recently not a single dive-bomber was employed.

O. M. ETOE.

Spitfire IX and Thunderbolt Compared.

IN reply to "Squita's" letter published in Correspondence, March 18th, I should like to point out that the Republic Thunderbolt is as yet untried in war. The performance at height is undoubtedly good, but should scarcely exceed that of the Spitfire IX with the Merlin 61 and two-speed supercharger.

As for manœuvrability, the Thunderbolt is the heaviest fighter built, and has a very high wing loading, and I entirely disagree that it is more manœuvrable than the Spitfire.

Though the armament of the Thunderbolt, eight 0.5in. machine guns, is very great, the four Hispano cannon and four 0.303 machine guns of the Spitfires already used over Malta are heavier.

Though the turbo-supercharger of the Double Wasp may give a slightly higher speed at 35,000ft. plus, the two-stage supercharger of the Merlin 61 should very nearly cancel this out, and there should be very little difference in the performance at great height.

"THE HIGHER THE FEWER."

Boston and Mitchell Armament Compared

IN the great controversy on the best types of aircraft which now seems to be raging in *Flight*, may I express my opinions?

First, in regard to the letter of G. E. D. Ross, published on March 26th. He states that the Boston III has "a very much better armament than the Mitchell." Obviously he is under a misapprehension. The Boston III does have one more machine gun than the Mitchell, but it should not be forgotten that those of the Mitchell are of 0.5in. and are far more deadly and effective than the 0.303in. guns of the Boston III. Further, two pairs of the Mitchell's guns are mounted in power-operated turrets, which gives a decided advantage over the hand-operated guns of the Boston. In any case, the Boston comes into the class of light bomber.

Secondly, the case of the Do. 217E2. Though this aircraft is superior to others in bomb load and in the number of guns it carries, but not, as many state, in speed, I prefer a medium bomber with most of its defensive armament in power-operated turrets—which virtue the Do. 217E2 does not possess to a very great extent.

In the majority of his choices I agree with "Ex-R.F.C.'s" original list, though I submit my own below.

Operational Class.	Best Type.	Nationality.
Single seat fighter and interceptor ...	Typhoon	British
High altitude fighter	Spitfire IX	British
Long range day and night fighter ...	Mosquito	British
Night Intruder	Boston III and Havoc II	American
Daylight fighter bomber	Whirlwind	British
Long range fighter bomber	Ju 88, A6	German
Short range reconnaissance	Mustang	American
Long range reconnaissance	Mosquito	British
High speed light bomber	Mosquito	British
Medium bomber	Marauder (B.26c)	American
Heavy bomber	Lancaster	British
Daylight heavy bomber	Liberator III	American
Ground attack	Hurricane (Tank buster)	British
Naval fighter	Seafire Ic.	British
Naval torpedo bomber	Barracuda	British
Land based torpedo bomber... ...	Beaufort	British
Naval dive bomber	Helldiver	American
Long range naval patrol	Sunderland II	British
Transport landplane	Commando	American
Transport flying boat...	Boeing 314A	American

The Barracuda is now officially stated to be first class. I will not comment upon the other types, though some will no doubt disagree with my choice.

WILLIAM B. RICHARDSON.

INTERNATIONAL AIR POLICE

Decentralisation of Control is the Remedy

THE main answer to Mr. Charlton's letter published on March 25th commending the article of "Ajax" is: "If you can't solve your problems on a small scale, why should you expect to solve them by making them bigger?"

At best, internationalisation is an attempt to abolish quarrels between nations by abolishing nations, and is about as sensible as trying to abolish quarrels between individuals by abolishing individuals. Decentralisation of control—the reclaiming and reuse of initiative by individuals in association with the smaller institutions and organisations—is what is necessary for the attainment and maintenance of peace, freedom and security.

"The Big Idea," a small work, written by Major C. H. Douglas, is a good witness that bigness is no criterion of greatness.

Congratulations on *Flight's* new series of articles advocating the merits of helicopters.

"GYPSY."

TAILPLANE DIHEDRAL

Trial and Error Method in Design

WITHOUT wishing to disparage in any way the undoubted skill and knowledge of aircraft engineers, it would appear that much still remains to be discovered about tailplanes and that, in the absence of a proven theory on the subject, the essentially practical "trial and error" method still largely dominates.

To the question of tailplane dihedral and position can be added that of how many fins and rudders; the Manchester first appeared with a triple tail, but was later reduced to two; the CW 20 began life with two fins and rudders, but subsequently swapped this arrangement for a large single unit, to quote but two examples.

Reverting to tailplanes, I am told that the idea of lifting them high on the fin (e.g., Whirlwind) or setting at a dihedral angle is to remove them from the disturbing influences of vortices from the engine nacelles; yet this has not been found necessary on the Mosquito, Blenheim, Beaufort, Oxford, Wellington, Baltimore, Ju 88, Hs 129—to mention a few that occur to me off-hand.

At the risk of incurring the amused contempt of the experts, may a groping student ask why?

"HIT AND MISS."

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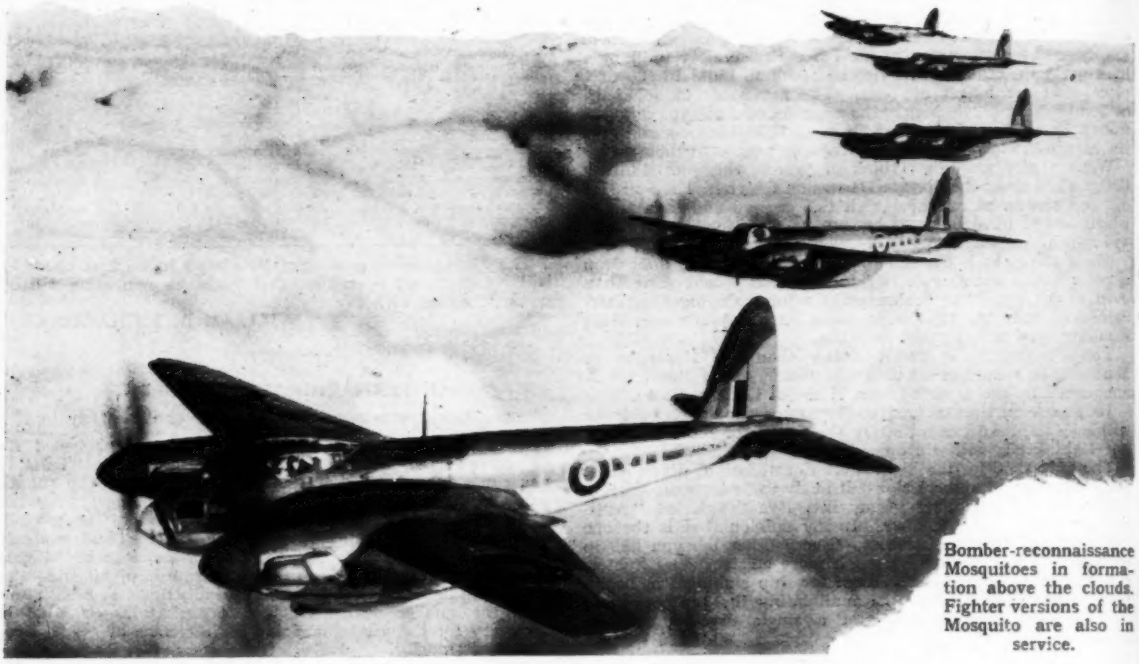

Bomber-reconnaissance Mosquitoes in formation above the clouds. Fighter versions of the Mosquito are also in service.

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

GENERAL DUTIES BRANCH

Air Marshal Sir A. T. HARRIS, K.C.B., O.B.E., A.F.C., to be Act. Air Chief Marshal. March 18th, 1943.

Air Vice-Marshal Sir A. CONINGHAM, K.C.B., D.S.O., M.C., D.F.C., A.F.C., to be Act. Air Marshal. February 8th, 1943.

Air Comdre. H. S. KERBY, D.S.C., A.F.C., to be Act. Air Vice-Marshal. March 5th, 1943.

Air Comdre. E. B. C. BETTS, D.S.C., D.F.C., to be Act. Air Vice-Marshal. March 14th, 1943.

Retirement

ACCOUNTANT BRANCH.

Group Capt., temp. Air Comdre. H. J. DOWN is placed on the retired list on account of ill health and retains rank of Air Comdre. December 1st, 1942.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

Second Bar to Distinguished Service Order

Act. Wing Cdr. P. C. PICKARD, D.S.O., D.F.C., No. 161 Sqn.—This officer has completed a very large number of operational missions and achieved much success. By his outstanding leadership, exceptional ability and fine fighting qualities, he has contributed in a large measure to the high standard of morale of the squadron he commands.

Distinguished Service Order

Sqn. Ldr. J. B. SELBY, D.F.C., R.A.F.V.R., No. 73 Sqn.—Since being awarded the D.F.C. this officer has completed much operational flying at night. Throughout he has displayed outstanding leadership and determination, setting a splendid example to the squadron he commands.

Wing Cdr. W. G. WELLS.—This officer has taken part in operational flying since April, 1941. During August and September, 1941, he flew on many sea patrols with considerable success and later participated in operations from Malta. From September, 1942, he has led his wing on bomber escorts and sea patrols.

Act. Sqn. Ldr. R. HILTON, D.F.C., R.A.F.V.R., No. 83 Sqn.—Sqn. Ldr. Hilton has completed numerous operational sorties since the award of a bar to the D.F.C. He participated with success in a daylight attack on the submarine yards at Danzig in adverse weather. He also completed a daylight attack on the Ruhr, undeterred by lack of cloud and by fierce opposition.

Act. Sqn. Ldr. S. P. DANIELS, D.F.C., R.A.F.V.R., No. 83 Sqn.—Since the award of a bar to the D.F.C. this officer has participated in a number of operational sorties from most of which he has returned with excellent photographs of the target area. On a recent occasion, when detailed to attack Hamburg, one of his aircraft's engines failed early on the outward journey. Undaunted he proceeded with his mission, successfully bombed the target and returned safely to base.

Act. Flt. Lt. J. E. PARTRIDGE, D.F.C., R.A.F.V.R., No. 93 Sqn.—In the course of a most outstanding operational career this officer has participated in attacks against many of the most heavily defended enemy targets, including Bremen, Danzig, Essen and Hamburg. During these flights he has contended with adverse weather and fierce opposition which has damaged his aircraft, but undeterred he has always succeeded in completing his mission. On a recent sortie against Hamburg, one engine failed shortly after leaving base. Undismayed by this occurrence Flt. Lt. Partridge continued his flight, which he completed successfully though only just able to maintain the necessary height. On another occasion recently, when attacking Stuttgart, he descended to 3,000 feet, despite intense anti-aircraft fire, to ensure accurate bombing.

Act. Flt. Lt. N. F. WALKER, D.F.C. No. 83 Sqn.—Since being awarded the D.F.C. this officer has continued to display great eagerness for operational duties. While acting as Squadron Navigation Officer he rendered valuable services in training crews. Flt. Lt. Walker has participated frequently, as a volunteer, in attacks on the most heavily defended targets in Germany, exhibiting throughout unflinching determination and superb navigational skill.

Bar to Distinguished Flying Cross

Flt. Lt. A. J. PUTT, D.F.C., R.A.F.V.R., No. 138 Sqn.

Act. Wing Cdr. D. F. BURTON, D.F.C.—Since he assumed command of the wing in December, 1942, this officer has taken part in nearly all its sorties. On one occasion the formation was attacked by a very large force of enemy fighters, one of which Wing Cdr. Burton shot down.

Act. Flt. Lt. C. J. SAMOUELLE, D.F.C., R.A.F.V.R., No. 92 Sqn.—This officer is a very determined and courageous fighter. He has destroyed at least seven and damaged several more enemy aircraft in combat.

F/O. N. F. DUKE, D.F.C., R.A.F.V.R., No. 92 Sqn.—One day in January, 1943, this officer led his flight in an engagement against a large force of enemy fighters. During the combat F/O. Duke fought with great resolution, destroying two enemy aircraft before all his ammunition was expended. Since being awarded the D.F.C. he has destroyed three hostile aircraft, bringing his victories to eleven.

F/O. M. C. SHIPARD, D.F.C., R.A.A.F., No. 89 Sqn.—This officer is a resolute and skilful pilot. Since the beginning of December, 1942, he has destroyed six enemy aircraft at night, bringing his total victories to thirteen.

Major W. A. NEL, D.F.C., S.A.A.F., No. 40 Sqn.—During the advance in the Western Desert, this officer completed many reconnaissances of outstanding merit, including flights over Tobruk, El Agheila and Sirte. On several occasions his aircraft has been intercepted by enemy fighters. Nevertheless, Major Nel has succeeded in returning to base with valuable information. During a mission in November, 1942, he piloted one of two aircraft which were intercepted by six enemy fighters. Major Nel engaged the enemy and it was largely due to his efforts that valuable information was brought back.

Act. Flt. Lt. W. L. CHISHOLM, D.F.C., R.C.A.F., No. 92 Sqn.—This officer has taken part in the squadron's activities since its arrival in the Western Desert. On one occasion he led the squadron in an attack on a force of enemy fighters and, in the ensuing engagement, two of them were destroyed without loss. Flt. Lt. Chisholm has destroyed six enemy aircraft.

Act. Wing Cdr. S. G. WISE, D.F.C.—Wing Cdr. Wise has commanded his unit since May, 1942. Since being awarded the D.F.C. he has completed a very large number of operational flying hours. Despite the great handicap of monsoon weather he has obtained some excellent photographs and brought back valuable information.

Sqn. Ldr. E. COTON, D.F.C., No. 97 Sqn.—Since being awarded the D.F.C., Sqn. Ldr. Coton has completed many successful sorties, which include attacks against the most heavily defended German cities and also against Italian targets.

Act. Flt. Lt. W. B. OLIVER, D.F.C., R.A.F.V.R.,

SERVICE AVIATION

No. 106 Sqn.—Since the award of the D.F.C. this officer has continued to participate in attacks on a wide variety of targets in Germany and Italy. His sorties include raids on Gdynia, Essen and Berlin and the daylight attacks on Le Creusot and Milan.

Distinguished Flying Cross

Lt. Col. R. A. BLACKWELL, S.A.A.F.—This officer has completed a large number of operational sorties during his eight months' service in the Western Desert. In night flying operations he has displayed a fearless determination to engage the enemy, regardless of the odds against him.

Lt. Col. C. S. COPPEN, S.A.A.F.—As squadron commander, this officer has displayed a high standard of operational efficiency. One night in January, 1943, he led an attack by Baltimore aircraft on enemy transport on the Misurata road. The sortie proved successful, giving the aircrews great confidence. Within the next eight days Lt. Col. Coppen led several of the one hundred sorties which were made in this type of aircraft.

Major F. KOTZE, S.A.A.F.—Since Major Kotze has been in command of his squadron he has led a number of operational sorties, the majority of which have been by night. His enthusiasm for night flying operations has set a splendid example to his crews.

Flt. Lt. R. R. SMITH, No. 112 Sqn.—Flt. Lt. Smith is a courageous fighter. In October, 1942, on his first sortie with the squadron he shot down one of four Messerschmitts which were intercepted. Some days later, during a bombing sortie, he destroyed an Italian aircraft after evading an enemy fighter which had pursued him. In December, 1942, Flt. Lt. Smith destroyed two enemy aircraft on one sortie, bringing his total victories to eight.

Picked Up Pilot.

Flt. Lt. H. H. CLARKE, No. 250 Sqn.—This officer has taken part in many operational missions both over Northern France and in the Middle East. He has invariably displayed great courage and determination, while his excellent work has contributed materially to the successes obtained. On one occasion, following a determined attack on an enemy airfield, Flt. Lt. Clarke landed in very rough terrain and under shell fire, and picked up a pilot of his formation who had been forced to make a crash landing. He afterwards flew safely back to base. He has destroyed two enemy aircraft, one of them at night.

Act. Flt. Lt. C. F CAMPBELL, R.A.F.V.R., No. 109 Sqn.

Flt. Lt. J. TURNBULL, R.A.F.V.R., No. 109 Sqn.—One night in January, 1943, Flt. Lts. Campbell and Turnbull were captain and navigator respectively of an aircraft attacking Dusseldorf. During the run up to the target the aircraft commenced to vibrate violently but, in the face of great difficulties, Flt. Lt. Campbell resolutely completed his attack. Immediately afterwards the starboard engine caught fire and became unserviceable. On the homeward flight, when nearing the Dutch coast, the port engine lost some power, causing the aircraft to lose height. Despite this, Flt. Lt. Campbell flew the aircraft back and made a safe landing at an airfield in this country. Throughout Flt. Lt. Turnbull displayed navigation of the highest order which contributed materially to the safe return of the aircraft.

F/O. W. T. H. GILL, R.C.A.F., No. 73 Sqn.—F/O. Gill has taken an outstanding part in the squadron's night flying operations and, during the operations leading up to the fall of Tripoli, achieved many excellent results from low-level attacks.

F/O. A. G. HUNTER, R.C.A.F.—During the last five months F/O. Hunter has taken part in very long flights in single-engined aircraft over sea and heavily defended areas. He has had to come down low to photograph enemy targets on several occasions.

F/O. J. MCGILL, R.A.F.V.R., No. 73 Sqn.—Since the campaign for Tripoli began this officer has flown on many sorties, including reconnaissances and low-level attacks on enemy transport. On one occasion in November, 1942, during a low-flying attack on enemy motor transport, his aircraft was severely damaged by opposing fire from the ground. Although two of his petrol tanks were pierced, F/O. McGill flew his damaged aircraft safely to base.

Lt. F. WELGEMOED S.A.A.F., No. 40 (S.A.A.F.) Sqn.—Lt. Welgemoed has completed a large number of tactical reconnaissances. Although he has been intercepted by the enemy several times and has once been shot down, his enthusiasm and determination for operational flying are undiminished.

P/O. D. R. WISEMAN, R.C.A.F., No. 73 Sqn.—Throughout the operations beginning in October, 1942, this officer has participated in a large number of sorties and patrols over enemy territory. He has always pressed home his attacks regardless of the opposition encountered. P/O. Wiseman has made many highly successful attacks on moonlight nights at a very low level, destroying much enemy transport.

Act. Sqn. Ldr. M. C. H. BARBER, R.A.F.V.R., No. 450 (R.A.A.F.) Sqn.—As flight and squadron commander his steady judgment and high morale proved a tower of strength. In one flight during the battle of El Alemein, Sqn. Ldr. Barber destroyed three Ju 87s.

Flt. Lt. J. G. COLE.—This officer has completed a large number of operational missions, involving long and arduous flights over heavily defended areas.

Flt. Lt. F. SCHAAF, R.A.A.F., No. 450 (R.A.A.F.) Sqn.—This officer has taken part in many operational sorties and has destroyed three enemy aircraft in combat. On one occasion, when attacking Castel Benito, he destroyed an enemy aircraft on the ground. Two days later, Flt. Lt. Schaaf led a formation in an attack on five Fw 190s, three of which were destroyed.

Act. Flt. Lt. G. W. TROKE, R.C.A.F., No. 250 Sqn.—This officer has destroyed three enemy aircraft, two of which he shot down on one sortie; he has also assisted in the destruction of two more enemy aircraft.

Lt. G. LLOYD, S.A.A.F., No. 40 Sqn.—On one occasion in November, 1942, this officer was the pilot of one of two aircraft which were intercepted by a number of enemy aircraft over the El Agheila area. During the ensuing fight his comrade was shot down, but Lt. Lloyd, although his own aircraft was damaged, continuously engaged the enemy fighters. Thus his comrade was enabled to land his crippled aircraft safely and later rejoin his squadron.

P/O. D. IBBOTSON, R.A.F.V.R., No. 601 Sqn.—In the campaign in the Western Desert P/O. Ibbotson has flown with great distinction, and has destroyed at least seven enemy aircraft. On one occasion he crash-landed near Mersa Matruh, but, aided by friendly Arabs, he was enabled to rejoin his unit.

P/O. M. S. JONES, R.A.F.V.R., No. 73 Sqn.—In the campaign in the Western Desert he has taken part in many operations against enemy ground targets. Pressing home his attacks from low level, he has caused the destruction of a large number of trucks and vehicles.

P/O. L. J. SHEPPARD, R.A.F.V.R., No. 260 Sqn.—During the advance in the Western Desert this officer participated in a large number of sorties, including many low bombing and machine gun attacks. In combat, P/O. Sheppard has destroyed three enemy aircraft. On one occasion he took part in an engagement against a force of five Me 109s, all of which were destroyed, one of them by P/O. Sheppard.

Sqn. Ldr. A. P. CRAIGIE, R.A.F.V.R., No. 148 Sqn.—This officer completed numerous sorties in the Western Desert. In several determined attacks on Tobruk he achieved much success despite heavy opposition from the ground defences. On one occasion, after setting course for base, he returned to the target area and dived to 3,000 feet to release a large bomb, which had not been released in his first attack, on a heavy gun position. Sqn. Ldr. Craigie has attacked many enemy concentrations. On one occasion he descended to 700 feet to rake a column of tanks and vehicles with machine gun fire. A large fire was started and much confusion ensued. On another occasion he disorganised a convoy of motor transport by his bombing.

Act. Flt. Lt. J. R. COLLINS, No. 3 Sqn.—This officer has completed a large number of operational missions. On two occasions he has attacked and damaged an enemy aircraft whilst flying over enemy airfields. On other occasions he has inflicted damage on three barges and four locomotives.

F/O. J. R. BALDWIN, R.A.F.V.R., No. 609 Sqn.—This officer has participated in numerous sorties, invariably displaying great courage and operational efficiency. This was amply demonstrated during a sortie one day in January, 1943, when he attacked a formation of three enemy aircraft. In his first attack, F/O. Baldwin shot down the leading aircraft of the hostile formation. Following this success he destroyed another of the formation before his own aircraft was hit in one of the wings. When the third enemy fighter attempted to attack from the rear, F/O. Baldwin outmanœuvred the attacker and shot it down. On another occasion, during a sortie over Belgium, he damaged four locomotives.

Wing Cdr. L. C. SLEE, D.S.O., No. 49 Sqn.—Wing Cdr. Slee has made a number of well-executed and determined attacks on German and Italian targets. Since being awarded the D.S.O. he has taken part in a number of further sorties. In October, 1942, Genoa was bombed from 8,000 feet and two days later he led his squadron on a daylight raid on Milan, making his attack from 3,500 feet. In November, 1942, he took part in a daylight operation on Osnabrück and descended to within 700 feet before releasing his bombs. On all these occasions he brought back photographs.

Act. Wing Cdr. R. C. O. LOVELOCK, No. 461 R.A.A.F. Sqn.—Both as C.O. and as captain of aircraft this officer has set an outstanding example to the members of his squadron. Throughout his long operational career he has distinguished himself by his skill and coolness.

Sqn. Ldr. D. A. BRAITHWAITE, No. 521 Sqn.—Sqn. Ldr. Braithwaite has completed a large number of meteorological flights over Great Britain and the North Sea. Owing to his devotion to duty the squadron, for whose work he is entirely responsible, has maintained a high standard of efficiency throughout.

Essen Attacks

Act. Sqn. Ldr. D. A. J. MCCLURE, No. 83 Sqn.—Sqn. Ldr. McClure has completed a large number of successful sorties, many of which have been against the most heavily defended targets. On one occasion during an attack on Essen his aircraft was engaged by night fighters and the two rear gunners were seriously injured. The aircraft was badly damaged before the enemy fighters were finally eluded by the skilful evasive action of this officer. In a subsequent attack on Essen, Sqn. Ldr. McClure's aircraft was heavily engaged by the ground defences. Despite this he pressed home the attack, but the aircraft was hit and Sqn. Ldr. McClure was seriously wounded. After a period in hospital he displayed an undiminished keenness for operational duties.

Major W. S. CLARK, S.A.A.F., No. 69 Sqn.—Since May, 1942, Major Clark has been in charge of a flight of Wellington bombers. He has flown on shipping searches and attacked enemy convoys. On two occasions he secured hits on enemy merchant vessels.

Major D. U. NEL, S.A.A.F., No. 24 (S.A.A.F.) Sqn.—This officer has proved himself invaluable as second in command of the squadron. His brilliant leadership has played no small part in the successes achieved by the squadron.

Act. Sqn. Ldr. E. I. J. BELL, No. 12 Sqn.—This officer has participated in operational sorties over many heavily defended targets, including Berlin, Kiel and the Ruhr. These attacks have invariably been completed with courage and skill.

Act. Sqn. Ldr. L. F. PENNY, No. 113 Sqn.—Sqn. Ldr. Penny has been continuously employed on operational flying since July, 1941, and for the last seven months he has served as Flight Commander. He has taken part in low-level attacks on enemy shipping and installations at Tripoli, also many sorties in the Western Desert and Japanese occupied Burma.

Flt. Lt. W. A. C. BALL, R.N.Z.A.F., No. 156 Sqn.—This officer has completed operational flights over many heavily defended enemy targets in Greece, Libya, Italy and Germany. He took part in the "1,000 Bomber Raids" on Cologne and the Ruhr.

Flt. Lt. D. H. T. HILDYARD, No. 205 Sqn.—During an exceptionally long operational career Flt. Lt. Hildyard has displayed ability, initiative and resource, both in the normal routine of convoy escort and anti-submarine patrol duties. On one occasion he was instrumental in rescuing

An Arado 196 reconnaissance seaplane on the catapult of a German cruiser.

SERVICE AVIATION

R.A.F. personnel stranded at Nancowry in the path of the advancing Japanese. He and his crew then succeeded, without special facilities, in rendering the entire base useless to the enemy and in removing valuable equipment. On two occasions this officer has assisted in the rescue of merchant seamen from lifeboats, and without mishap he has ferried various officers of high rank.

Flt. Lt. G. H. F. PLINSTON, No. 250 Sqn.—Flt. Lt. Plinston has a long record of operational flying. In the early days of the war he served in France, and in May, 1940, flew in patrols over Dunkirk. He has destroyed at least seven enemy aircraft.

27 *Hours' Flight*

Flt. Lt. F. SQUIRE.—In December, 1942, orders were given for a special reconnaissance involving a flight of over 2,000 miles over the sea. Flt. Lt. Squire agreed to captain this sortie. A successful take-off was made, despite a very rough sea and high wind, and after a 27 hours' flight Flt. Lt. Squire landed the aircraft safely. The greater part of the flight was completed in very bad weather and thick cloud, which made navigation particularly difficult.

Capt. K. C. KUHLMANN, S.A.A.F., No. 185 Sqn.—This officer has at all times exhibited the utmost keenness to engage the enemy, and his courage has been a magnificent example to the members of his flight. Capt Kuhlmann has personally destroyed at least three enemy aircraft.

Act. Flt. Lt. T. J. BEACH, R.A.F.V.R., No. 61 Sqn.—Flt. Lt. Beach is an outstanding bombing leader and navigator who exerts a fine influence on the squadron. Flt. Lt. Beach recently took part successfully in the raids on Berlin.

Act. Flt. Lt. J. L. BIRBECK, R.A.F.V.R., No. 218 Sqn.—Early in his operational career, Flt. Lt. Birbeck participated in a raid on Hamburg, during which his aircraft was badly damaged in an encounter with a night fighter. The prompt action taken by Flt. Lt. Birbeck resulted in driving off the enemy aircraft, which was last seen in a dive. This officer has also participated in attacks on many long-distance targets. In July, 1942, he took part in the daylight raid on Lubeck.

F/O. H. R. FIGG, D.F.M., No. 161 Sqn.

F/O. R. W. TAYLOR, R.C.A.F., No. 161 Sqn. (since reported missing).—These officers have completed a large number of sorties, invariably displaying outstanding skill and devotion to duty. The successes achieved reflect the greatest credit on their efforts which are worthy of the highest praise.

Sqn. Ldr. C. F. GIBSON, No. 138 Sqn. (since reported missing).—This officer has at all times displayed high courage and outstanding devotion to duty. Early in the Battle of France he was grievously wounded, but recovered to render excellent service, completing many operational missions. In addition, he has accomplished good work in the training of aircrews.

Act. Sqn. Ldr. A. H. C. BOXER, No. 138 Sqn.—Within the last two months, Sqn. Ldr. Boxer has successfully completed several long-range sorties. On one of them, when some hundreds of miles from base, one engine of his aircraft failed. Despite this, he succeeded in flying the bomber home. Some time later, he completed the return flight from a distant target in similar circumstances.

Act. Sqn. Ldr. R. B. BAGGULEY, No. 139 Sqn. (since reported missing).

Flt. Lt. M. M. WAYMAN, No. 139 Sqn.

Act. Flt. Lt. C. K. HAYDEN, No. 139 Sqn. (since reported missing).

F/O. G. S. CLEAR, R.A.F.V.R., No. 139 Sqn.—In March, 1943, these officers were members of aircraft crews detailed to attack the molybdenum plant at Knabon, Norway. Such a task, necessitating a flight over mountainous terrain covered by a blanket of snow which obscured all prominent features, demanded the highest degree of leadership and skill. At various points the formation had to fly through deep ravines and contend with most treacherous air currents. Despite this, the correct target, hidden away in the mountains, was located and subjected to a telling attack from a low level.

Act. Flt. Lt. R. R. GLASS, R.A.F.V.R., No. 214 Sqn.—This officer has taken part in a large number of sorties, involving attacks on various heavily defended targets. On one occasion, on the outward flight to a target in Germany, his aircraft was attacked by two enemy fighters. Skilfully manœuvring his aircraft, Flt. Lt. Glass enabled his rear gunner to deliver an accurate burst at one of the attackers, causing it to dive away with its engine on fire. Although the bomber was damaged during the engagement, Flt. Lt. Glass flew it back to base.

P/O. P. M. ANDERSON, R.C.A.F., No. 97 Sqn.—This officer has completed a large number of sorties, including seven attacks on targets in Italy. One night in February, 1943, he completed a successful attack on Lorient in difficult circumstances. Three nights later, he flew with distinction in an attack on the same target.

P/O. C. R. BLUMENAUER, R.C.A.F., No. 103 Sqn.—Since the beginning of February, 1943, this officer has completed a number of night sorties against targets in Germany, Italy and Northern France. He has never failed to reach his objective, and has pressed home his attacks with accuracy and determination. In operations against Lorient, Milan and Cologne, P/O. Blumenauer obtained excellent photographs.

P/O. A. R. FOOLE, R.A.F.V.R., No. 97 Sqn.—P/O. Poole is an air gunner of high merit. He has taken part in a large number of operational flights, including many in the Middle East. On one occasion he was forced to abandon his aircraft over the desert. Four days later he was picked up by an army patrol. P/O. Poole took part in the raids on the Ruhr and Bremen, when 1,000 of our bombers operated; he has also flown on three attacks against Berlin.

P/O. G. F. H. SAVERS, No. 90 Sqn.—This officer has completed a large number of operational missions. He is an exceptionally determined pilot who invariably presses home his attacks with skill and courage.

Distinguished Flying Medal

Flt. Sgt. W. J. M. L. BARCLAY, R.N.Z.A.F., No. 156 Sqn.—In the course of his operational career this airman has participated in numerous attacks on targets in Germany and Italy. At all times he has displayed high courage and skill in the execution of his duties.

Flt. Sgt. J. A. BOTT, No. 83 Sqn.—Throughout his operational career Flt. Sgt. Bott has displayed the utmost keenness to fly on operations, together with a complete and thorough knowledge of his work. In September, 1942, while attacking Duisburg, his aircraft was engaged by particularly heavy anti-aircraft fire and was coned by many searchlights. Flt. Sgt. Bott remained cool and efficient, and gave directions from the astrodrome which enabled his captain to complete the mission successfully with little damage to the aircraft. On another occasion, while returning from an attack on Berlin, this airman was to a large extent responsible for the safe landing of the aircraft in this country after a long and hazardous flight with two engines unserviceable.

Flt. Sgt. G. F. CALDWELL, No. 101 Sqn.—Flt. Sgt. Caldwell has proved himself to be a most efficient and courageous airman. His navigational ability has largely contributed to the outstanding success attained by his squadron. He has participated in a determined and effective attack on Emden Docks, and on two other occasions when his aircraft was severely damaged, their safe return was due chiefly to his coolness and skill.

Flt. Sgt. A. CLIFT, No. 7 Sqn.—Flt. Sgt. Clift is an exceptionally reliable air gunner whose coolness and efficiency in action are outstanding. Throughout his operational career he has conducted himself in a most exemplary manner.

Flt. Sgt. (now P/O.) B. COOK, R.C.A.F., No. 97 Sqn.—This airman has participated in numerous operational sorties against enemy targets, including nearly all the most heavily defended centres in Germany and Italy. He also took part in the daylight raid on Le Creusot.

Flt. Sgt. E. M. COPLEY, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Throughout his operational career Flt. Sgt. Copley has displayed a highly commendable keenness and devotion to duty. In August, 1942, during an attack against Kassel, he acted as fire controller whilst being attacked by enemy aircraft. His efficient orders enabled the rear gunner to hit the enemy aircraft, and his captain to take effective evasive action.

Flt. Sgt. W. J. CRIMMIN, No. 115 Sqn.—This airman has completed a number of most successful operational missions in the course of which he has set a fine example of leadership. On one occasion in spite of severe damage sustained by his aircraft during a raid, he flew back safely to base and accomplished a skilful crash landing.

Flt. Sgt. R. CROSTON, No. 57 Sqn.—Flt. Sgt. Croston has taken part in a number of successful operational sorties. In June, 1942, he was serving as captain of aircraft when during an attack on Bremen a Me 210 was probably destroyed. Again in July, 1942, when returning from Bremen a Ju 88 was shot down off the English coast.

Operational Since 1940

Flt. Sgt. T. J. DRABBLE, No. 59 Sqn.—Flt. Sgt. Drabble flew on his first operational sortie in December, 1940, when he attacked an airfield at Deauville from 100 feet. Since then he has participated in many hazardous operations over Brest and the Channel ports. He has also taken part in daylight attacks on E-boats and other enemy shipping. On one of these occasions he was wounded in the thigh. In addition Flt. Sgt. Drabble has made a number of low-level night bombing attacks on well-defended enemy convoys. Recently he made a determined attack on a German destroyer and a U-boat entering an enemy harbour, despite intense opposing fire.

Flt. Sgt. B. DE FRIEND, No. 207 Sqn.—While attached to Coastal Command this airman successfully bombed an enemy submarine. Later he took part in numerous sorties against German targets such as Essen and in daylight raids on Le Creusot and Milan.

Flt. Sgt. P. L. ELLIOTT, R.A.A.F., No. 61 Sqn.—Flt. Sgt. Elliott has completed many successful operational sorties which have included daylight raids on Milan and Le Creusot and attacks on Berlin and Essen.

Flt. Sgt. J. C. GOODSON, No. 35 Sqn.—Flt. Sgt. Goodson has displayed keenness to participate in any mission against the enemy. The success of many sorties has been largely due to his fine example and his exceptional ability as flight engineer.

Flt. Sgt. A. H. HAMMET, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—One night in December, 1942, Flt. Sgt. Hammet was wireless operator of an aircraft detailed to attack Duisberg. On the return journey his apparatus was seriously damaged by gunfire, and became unserviceable. In addition the compasses failed, but Flt. Sgt. Hammet was able to improvise communications which gave the navigator valuable assistance which enabled the aircraft to be flown safely back to base.

Flt. Sgt. H. HEAD, No. 7 Sqn.—This airman is a most valuable member of air crew who has completed a large number of operational sorties in heavy bomber aircraft. The record of serviceability of his aircraft over a long period has been outstanding, and this has been in a great part due to his conscientious and untiring efforts.

Sgt. G. C. MCDOUGLE, No. 10 Sqn.—An air gunner, this airman has flown on a large number of operational missions. In December, 1942, during a return flight from Duisburg, his aircraft was attacked by an enemy fighter from close range. Although two of his four guns jammed, Sgt. McDougle delivered a burst, causing the fighter to break away and fall towards the ground with its engine apparently on fire. In February, 1943, when returning from an attack on Wilhelmshaven, Sgt. McDougle observed an enemy fighter flying in to attack from astern. He immediately attempted to engage it, but his guns jammed. Coolly and skilfully he gave his captain a commentary on the enemy aircraft's movements, enabling him to evade it successfully. Shortly afterwards, another fighter appeared and attacked fiercely. Sgt. McDougle had only one gun serviceable, but, opening fire with it from very close range, he drove the attacker off. Suddenly it disintegrated in the air and burning pieces were observed to fall into the sea.

Flt. Sgt. D. JAMES, No. 214 Sqn.—On his many operational sorties, Flt. Sgt. James has always shown great courage and determination in locating the target. On three occasions his aircraft has been attacked by enemy night fighters. On the last occasion, although wounded in the back, Flt. Sgt. James successfully navigated the damaged aircraft back to base. One night in October, 1942, when returning from Genoa, the wireless transmitter and compasses in the aircraft became unserviceable. This airman's fine navigational skill enabled the pilot to return to base safely.

Flt. Sgt. J. A. KENNEDY, No. 106 Sqn.—Flt. Sgt. Kennedy has attacked targets in the Ruhr, at Mainz, Nuremberg, Munich and Rostock, besides participating in the two "1,000" raids. In addition he flew on the daylight attacks on Le Creusot and Milan, on both occasions using his guns effectively against ground targets. One night in August, 1942, when returning from a raid on Kassel, his accurate and steady fire drove off an enemy night fighter.

The King inspecting Fleet Air Arm aircraft and aircrews during a four-day visit to the Royal Navy.

George Medal

L.A/C. E. J. DRURY, No. 148 Sqn.—One night in December, 1942, a force of Wellington aircraft had been refuelled and loaded with bombs for a second operation when the airfield was attacked by enemy aircraft. Several of our bombers, some carrying 4,000lb. bombs, were hit and set on fire. Despite bombs bursting around him, L.A/C. Drury started the engines of a Wellington and taxied it to safety, passing between two other aircraft which were enveloped in flames. He then returned and taxied to safety a second aircraft, one wing of which was on fire. Both aircraft were loaded with bombs. By his exemplary conduct in the face of the gravest danger he saved two valuable aircraft from certain destruction.

Roll of Honour

Casualty Communiqué No. 217.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 28 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. H. R. Forster; Sgt. J. Henry; Sgt. J. B. Hood; Sgt. D. H. Scott; Flt. Sgt. J. B. Walenn.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. G. W. G. Harding.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. K. Ashurst; Sgt. R. N. Beale; Sgt. S. F. Bentley; Flt. Lt. M. B. Bowker; Flt. Sgt. S. J. Brown; Sgt. L. W. Calderhead; Sgt. M. W. Fenwick; Sgt. R. F. Lawrence; P/O. C. W. Lain; Sgt. D. McDonald; Sgt. C. Parry; Sgt. W. H. Peters; Sgt. G. F. G. Rackstraw; P/O. P. G. D. Thornton; Flt. Sgt. P. H. G. Webster.

WOUNDED OR INJURED IN ACTION.—Sgt. J. F. Bell; Sgt. G. A. J. Twinn.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. H. Addinali; Sgt. L. J. Bond; Sgt. B. D. Bridge; Sgt. E. J. Chapman; Flt. Sgt. H. R. Cox; Sgt. J. Eastwood; F/O. R. H. A. Evans; Sgt. G. Gray; Sgt. K. Holmes; Sgt. E. Jones; Sgt. F. H. Lukey; Sgt. A. S. Oakes; Sgt. J. B. Robertson; Sgt. M. I. Sharpley; Sgt. D. Sims; Sgt. G. J. Smale; Sgt. K. J. Teague.

MISSING.—Sgt. G. C. Adam; F/O. P. C. Astrosky; Sgt. F. L. Ayley; Sgt. R. F. Bannister; Sgt. S. D. Beadon; P/O. G. C. Bellman; Sgt. F. A. Boese; Sgt. J. T. Bostock; Flt. Lt. J. M. Bousfield, D.F.C.; Sgt. J. H. W. De Silva; Sgt. P. J. Egan; Sgt. N. Ellis; Sgt. R. C. Evans; Flt. Lt. R. H. B. Field; Flt. Sgt. A. R. F. Fortt; Sgt. J. P. Foster; F/O. J. Francombe; Sgt. H. A. S. Fraser; Sgt. J. Gallagher; P/O. D. S. Gallimore; Sgt. R. Hargreaves; Sgt. D. D. Hayward; Sgt. E. D. Hillen; Sgt. L. Hodgson; F/O. W. H. Hoggard; Sgt. L. H. Jenkins; Sgt. G. T. Kennington; Sgt. F. T. Lax; Sqn. Ldr. W. E. L. Lewis, A.F.C.; F/O. H. Lowe; Sgt. P. G. H. MacTavish; Sgt. C. Murray; Sgt. W. Osborn; F/O. F. A. Parton; W/O. W. J. Payne; Flt. Lt. P. Price; F/O. B. Samuel; Sgt. A. Short; Sgt. A. N. Sinclair; Sgt. G. Stephens; Flt. Sgt. A. G. Thomas; Sgt. D. J. Thomas; Flt. Lt. S. L. Treves; P/O. A. H. A. Treadwell; Sgt. J. B. Wallis; Sgt. A. Watson; Sgt. R. Webb; Sgt. R. T. Williams; F/O. J. K. Woollard; Sgt. C. H. Yoxall.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. P. A. Barr.

KILLED ON ACTIVE SERVICE.—Sgt. C. E. Aaron; Flt. Lt. J. F. H. Andrews; P/O. A. H. N. Bickley; P/O. R. G. Beevers; P/O. R. J. Binham; Sgt. M. J. Buckle; Sqn. Ldr. W. F. Carnaby; Sgt. T. H. Clapham; Sgt. A. S. Deull; L.A/C. A. H. Herbert; Sgt. E. Fawcett; Sgt. J. B. D. George; Sgt. A. T. Hadlow; P/O. J. H. L. Kemp; Sgt. D. B. Lister; Sgt. D. A. J. McDonald; Sgt. G. E. McGeown; P/O. A. G. Mole; Sgt. C. Muirhead; L.A/C. J. Saxby; Flt. Sgt. R. Smeaton; Sgt. A. T. Strachan; L.A/C. J. M. Thomas; Sgt. A. B. Wedderspoon; L.A/C. J. H. Wright.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. F. R. Burcher; L.A/C. L. E. B. Dymoke-Bradshaw; Cpl. J. R. Gibson; L.A/C. J. H. Howe; Sgt. R. A. Machin; Act. Cpl. A. J. Spiers; Cpl. A. Stewart.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. F. G. Dolphin; L.A/C. F. D. Dudley; Sgt. T. H. E. Henwood; P/O. R. H. B. Pellew.

DIED ON ACTIVE SERVICE.—L.A/C. R. G. Absalom; Sgt. C. J. Barley; Cpl. G. R. Benstead; L.A/C. A. F. Bloomfield; L.A/C. C. Brook; L.A/C. F. A. Brunton; L.A/C. J. G. Clelland; A/C.2 A. H. D. Day; A/C.1 J. A. Finch; Cpl. D. MacA. Fraser; L.A/C. H. Hadfield; A/C.2 A. Ibbotson; L.A/C. S. B. Kirkland; A/C.2 G. Longsdale; A/C.2 H. Mear; A/C.1 J. A. McGowan; L.A/C. C. S. McLellan; L.A/C. J. B. Patrick; L.A/C. T. Slater; A/C.2 W. Tomlinson; L.A/C. J. S. Wilkey.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. J. C. McCombie.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. H. H. Barnard; Flt. Sgt. C. L. Barringer; Sgt. P. C. Cottle; Sgt. G. H. Cross; Sgt. S. Fitton; Sgt. S. R. Lowe; Sgt. R. Marlow; Sgt. J. G. Meredith; Sgt. A. T. S. Williamson.

Women's Auxiliary Air Force

KILLED ON ACTIVE SERVICE.—A/CW.1 E. M. Hoy.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Cpl. K. D. Branston.

DIED ON ACTIVE SERVICE.—A/CW.1 R. M. Booker; A/CW.1 M. Booth.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. D. T. Martin.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. H. Hayes; Sgt. C. T. S. Parsons.

WOUNDED OR INJURED IN ACTION.—Sgt. K. C. Appelkamp; Sgt. N. F. Moses.

MISSING, BELIEVED KILLED IN ACTION.—Act. Sgt. J. Carr.

MISSING.—Sgt. W. M. Arnold; Act. Sqn. Ldr. H. T. Armstrong, D.F.C.; Sgt. G. H. Cameron; Flt. Sgt. A. T. Gell; P/O. E. P. Heinrich; Sgt. M. C. Harrison; Flt. Sgt. L. C. Laver; Sgt. H. W. Paradise; Flt. Sgt. E. F. Saggers; Sgt. B. W. Shearer; Flt. Sgt. D. A. Smith; P/O. A. E. H. Tonkin; Sgt. A. G. Wilson.

KILLED ON ACTIVE SERVICE.—P/O. B. J. Coleman; Sgt. J. E. Eason; P/O. N. A. T. Fleming; P/O. R. R. Heathcote.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. V. P. Daly.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. L. H. Curphey; F/O. J. B. Ferris; W/O. H. L. Gill, D.F.M.; F/O. K. W. Johns.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. A. L. W. Watt.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. A. J. Broemeling; Sgt. D. G. McL. Thompson.

MISSING, BELIEVED KILLED IN ACTION.—P/O. R. L. Alexander; Sgt. W. K. Ferguson; F/O. R. Harvie; Flt. Sgt. J. A. Moore; F/O. D. A. Power; P/O. A. McL. Skinner; Sgt. C. E. Wilde.

MISSING.—F/O. T. M. Falls; Flt. Sgt. I. Fraser; Sgt. J. E. Galbraith; P/O. R. D. Hann; P/O. G. D. MacDougall; Flt. Sgt. E. McDermott; Sgt. O. W. Stone; F/O. M. J. Sunstrum.

KILLED ON ACTIVE SERVICE.—Sgt. J. R. Arsenault; Sgt. J. L. Boivin; Sgt. D. C. Carder; Sgt. C. D. Donald; Sgt. G. M. Duda; Sgt. L. E. Gilpin; Sgt. H. F. Gorrie; Sgt. P. Larsen; Sgt. R. D. Maynard; Sgt. S. J. Prince; F/O. G. R. Pringle; F/O. H. G. Reynolds; W/O. D. R. Roberts; Sgt. W. H. Stewart; Sgt. F. A. Sullivan.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. McM. Hood.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. A. L. Murray.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. S. Durward; F/O. K. S. Kibble; Flt. Sgt. G. K. Ross; Sgt. P. T. W. Wiltshire.

MISSING.—P/O. K. H. Blincoe; Sgt. D. Clearwater; Sgt. G. W. Cook; Sgt. P. R. Karena; Sgt. J. D. Sclater; P/O. A. J. Scott; Sgt. W. S. Thompson; Sgt. G. H. Wunsch.

KILLED ON ACTIVE SERVICE.—F/O. M. A. Legg; Sgt. M. E. E. Robertson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. K. Archer; Sgt. F. A. Paterson.

South African Air Force

KILLED IN ACTION.—Capt. C. L. Cousins; Flt. Sgt. E. L. Kruger; Flt. Sgt. S. Miller.

MISSING.—Lt. H. F. Harvey.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. N. S. Gore; Cpl. J. R. Hully; Flt. Sgt. V. F. Neibuh; Air Mech. I. J. Pretorius; Lt. D. W. T. Robbins; Lt. R. E. Scott; Lt. J. D. Sinclair; Air Mech. D. N. Terblanche; 2/Lt. H. Visscher; Lt. P. R. Walker.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Air Mech. B. Grayling.

Indian Air Force

DIED ON ACTIVE SERVICE.—Cpl. M. H. Khan.

Casualty Communiqué No. 218

Of the names in this list 12 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. S. M. Austin; Sgt. G. Daglish; Sgt. W. Davis; Sqn. Ldr. H. S. Giddings; Flt. Sgt. D. Mallett; Flt. Sgt. J. H. E. Marriot; Sgt. N. E. Powell; Sgt. R. A. Singleton; P/O. R. D. Thompson; F/O. T. W. Ward.

Air Comdre. O. R. Gayford (left)—of Fairey long-range monoplane fame—talking to Air Vice-Marshal Broadhurst, A.O.C., Western Desert Air Striking Force.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. A. Cripps; Flt. Sgt. J. S. Flockhart; Sqn. Ldr. R. B. Harris.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. M. Angelo; Sgt. J. Easting; Sgt. S. D. England; Sgt. N. H. Kortright; Sgt. J. Parris; Sgt. R. McI. Paton.

WOUNDED ON INJURED IN ACTION.—Sgt. J. L. Brown; Flt. Lt. I. Campbell-Bruce; Sgt. D. W. Chapman; Sgt. K. P. Leach; Sgt. H. Shaw; Sgt. L. C. G. Venn.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. E. W. Eaglen.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. M. W. Baxter; F/O. C. R. M. Bell; Sgt. E. Berry; Sgt. A. S. Blagden; Sgt. H. D. Dawes; Sgt. W. R. Fisher; Sgt. W. O. Goff; Sgt. D. A. Gold; Sgt. R. Percival; Sgt. J. D. Perrett; P/O. A. H. Piggs; Sgt. A. D. Tidmarsh; Sgt. J. Ward.

MISSING.—Sgt. G. H. Anderson; Sgt. J. L. E. Barden; Sgt. S. Bell; Sgt. N. R. Bennett; Sgt. W. H. Bower; P/O. E. Bradley; Sgt. S. C. Brewer; Sgt. J. E. Brewster; Flt. Sgt. R. N. B. Brooker; Sgt. A. E. Brown; Sgt. J. H. Brown; W/O. R. C. Brown; Flt. Sgt. E. H. Burgess; P/O. W. H. Cappleman, D.F.M.; Sgt. F. R. W. Checketts; Sgt. P. B. Copp; Sgt. L. Cox; P/O. M. G. Coyle, D.F.M.; Sgt. W. E. Debeurier; Sgt. L. J. Dodd; Sgt. J. Dunne; Sgt. A. G. Dunick; Sgt. P. Evans; Sgt. P. Ferguson; Sgt. K. G. Ford; Sgt. P. D. Fowler; Sgt. R. W. Goffin; Sgt. G. Guerrier; Sgt. D. V. Gwilliam; Sgt. E. G. Harrold; Sgt. G. E. Harvey; Sgt. D. G. Heath; Flt. Sgt. J. S. Hill; Wing Cdr. C. C. Hodder, A.F.C.; Sgt. M. B. Holden; Sgt. D. Holmes; Sgt. R. Hordon; Sgt. J. T. Howe; Sgt. F. A. Hughes; Sgt. D. C. H. Hunt; F/O. J. S. Hustler; Sgt. J. C. Jacques; Sgt. J. R. J. Kau; Sgt. D. P. Kerr; P/O. J. L. Leigh; Sgt. H. Liddell; Sgt. R. F. Lillywhite, D.F.M.; P/O. R. H. Longhorn, D.F.M.; Sgt. J. G. McAteer; Sgt. J. F. McFarlane; Sgt. R. McNeill; Sgt. G. F. Mitchell; P/O. D. J. Murray; Sgt. H. J. Naylor; Sgt. S. J. Newton; Sgt. F. A. Nodes; Sgt. G. Oberhill; Sgt. W. J. Oram; Sgt. A. W. Parnell; Sgt. E. B. Parr; Sgt. S. E. Perry; Flt. Sgt. F. Quigley; Sgt. N. Ridley; Sgt. C. Risingham; Sgt. T. W. E. Robson; Flt. Sgt. H. A. Ross-Thomson; Sgt. J. W. Schofield; Sgt. R. M. Scratchley; Sgt. E. C. Selby; Flt. Lt. D. A. Shead; Sgt. P. J. Smith; Sqn. Ldr. W. A. Smith; P/O. I. N. Stirton; Sgt. J. Stuart; Sgt. A. R. Sutton; Sgt. R. Taylor; Sgt. B. Torrance; Sgt. I. C. Traill; Sgt. L. C. Trent; Sgt. S. D. Wall; Act. Flt. Lt. R. Watkin; Sgt. F. E. Williams; Sgt. A. M. Willis; F/O. I. R. Willis; Sgt. V. J. Wood.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—L.A/C. E. H. Bambridge; Act. Flt. Lt. T. H. Carson D.F.C.; Sgt. A. W. Cheyne; Sgt. M. Lupton; A/C.2 C. Stone.

KILLED ON ACTIVE SERVICE.—Sgt. W. Adams; Flt. Sgt. W. E. Atkins; Sgt. J. H. Beasley; P/O. G. E. Bell; P/O. L. R. Black; Sgt. D. Ditcher; Sgt. J. L. Downs; Sgt. J. P. Eden; Sgt. E. Fowell; Sgt. R. A. Fretwell; P/O. S. B. Fuller, D.F.M.; L.A/C. W. Gilbert; Sgt. E. J. Guth; Sgt. E. V. Horne; Sgt. P. Julyans; Sgt. A. R. MacKay; F/O. W. E. N. Maxwell; P/O. L. G.

SERVICE AVIATION

Morris; Sgt. F. O'Neill; Flt. Sgt. J. L. Owen; Sgt. F. H. Parker; Sgt. G. F. Priest; Sgt. S. J. Roche; Sgt. L. Rotherray; P/O. D. Shingleton-Smith; Sgt. W. W. Simms; Sgt. R. Williams; Sgt. P. Yarker.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. R. Edwards; A/C.1 J. H. Kelso; A/C.1 A. Kidd.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. D. F. Baker; Sgt. N. Ballance; Sgt. J. B. Burns; Sgt. J. Fidler; A/C.1 J. E. Grosvenor; Sgt. E. J. Howell; A/C.1 C. A. Tapp.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. R. Carruthers; A/C.2 A. G. Dromgoole. L.A/C. R. Elgey; Flt. Sgt. M. L. Lewis; Sgt. C. R. Young.

DIED ON ACTIVE SERVICE.—A/C.1 G. C. Cotterell; L.A/C. G. P. Grierson; Cpl. A. Thistlethwaite.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. M. M. Farmer.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. H. E. Beale; Sgt. E. P. Dubois.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. T. F. Dimmock.

MISSING.—Sgt. F. L. Boyd; Act. Flt. Lt. B. L. Buls; Sgt. J. C. Dangerfield; Sgt. R. Darken; P/O. H. I. C. Dent; P/O. A. G. Edwards; A/C.1 A. E. Elrick; Flt. Sgt. O. S. Filmer; Sgt. F. A. K. Gallagher; Sgt. J. W. J. Gill; Flt. Lt. T. H. Gordon-Glassford; Flt. Sgt. N. H. R. Hart; Sgt. E. V. Laing; Sgt. S. J. Lloyd; P/O. J. H. Moore; P/O. H. L. Osborne; Sgt. R. A. S. Tucker; Sgt. K. R. Webber; Sgt. D. G. Williams.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. H. F. Backhouse; P/O. A. K. B. Messer.

KILLED ON ACTIVE SERVICE.—P/O. J. M. Forsyth.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. G. W. H. Ebert; Sgt. L. E. Holland; Sgt. D. Udell; Sgt. J. W. Whear.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. J. S. Patterson.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. E. Campbell; Sgt. D. R. Dewar; Sgt. C. A. Gruchy; Sgt. A. M. Reynolds; Flt. Sgt. A. W. Stevenson; Flt. Sgt. F. R. Verrick.

MISSING.—F/O. W. B. Anderson; Sgt. F. J. Belanger; F/O. L. W. Birkinshaw; Act. Flt. Lt. W. A. Black; Flt. Sgt. R. P. Campbell; F/O. B. W. Carmichael; Sgt. K. G. Curtis; Flt. Sgt. W. J. Dempster; Sgt. G. R. Hoyt; Flt. Sgt. G. J. Hutchinson; Sgt. E. C. Lawrence; F/O. T. T. Lundberg; Flt. Sgt. R. J. T. Lynn; Flt. Sgt. F. T. Mattison; Act. Flt. Lt. O. K. Middleton; Sgt. M. Patrick; Sgt. J. L. Sparling; Sgt. J. R. L. Sterrett; Sgt. F. C. Stewart; Sgt. H. W. Traver; Sgt. D. H. Watt.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. T. A. McMillan; Sgt. G. G. Mills.

KILLED ON ACTIVE SERVICE.—Sgt. R. C. Alderson; Sgt. R. J. Archer; Sgt. W. Argo; Sgt. W. R. Harron; Sgt. M. J. Kelly; Sgt. K. H. Mount; Sgt. R. E. Oswald; Sgt. S. U. Trowbridge; Sgt. J. A. Wilson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. C. O'Haolon

DIED ON ACTIVE SERVICE.—Cpl. H. W. Yates.

Royal New Zealand Air Force

MISSING.—F/O. I. S. Johnson; Sgt. R. M. Kidd; Act. Flt. Lt. B. Martin.

KILLED ON ACTIVE SERVICE.—W/O. S. D. Earwaker.

South African Air Force

KILLED IN ACTION.—Lt. T. Jennings.

WOUNDED OR INJURED IN ACTION.—Lt. J. L. Burke.

DIED ON ACTIVE SERVICE.—Air Mech. H. S. Adams.

Casualty Communiqué No. 219

Of the names in this list 18 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. C. Baines; P/O. H. E. Bonest; P/O. F. R. Busby; Sgt. A. L. W. Cale; Sgt. J. D. Dodsworth; Sgt. R. P. Edwards; Sgt. W. A. Hall; F/O. A. C. Hamman, D.F.C.; Flt. Sgt. W. S. Hawkins; Flt. Sgt. J. R. Hilton; Sgt. A. I. Kitching; W/O. E. Neesom; Sgt. S. J. Ross Hoff; Sgt. A. R. P. Smith; Sgt. L. F. Smith; F/O. G. P. Stone; Sgt. J. E. White.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. A. Carruthers.

WOUNDED OR INJURED IN ACTION.—P/O. I. J. Edwards, D.F.M.

PREHISTORIC: Ground crews of a U.S. Naval air base turning over the cold engine of a Kingfisher by means of ropes and a blade-tip gauntlet. The Russians use a more positive arrangement of steel claw and Hucks starter.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. W. C. Bush; P/O. R. Moorhouse.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. Muskett.

MISSING.—Sgt. A. G. Allen; Sgt. G. Amos; Sgt. J. D. Appleby; Sgt. R. Bailey; Sgt. K. Batson; Sgt. E. P. G. Bayliss; Sgt. W. A. Bennett; Sgt. R. B. C. Bloom; Sgt. D. A. Booth; F/O. R. L. G. Bowyer; Sgt. J. R. Brierley; W/O. E. T. V. Bunt; Sgt. R. H. Cox; Sgt. G. Currah, Sgt. C. Davies; Sgt. J. G. Dawson; Sgt. De Amar Chandra; Sgt. J. W. Denby; Flt. Lt. P. D. Furniss; Flt. Sgt. C. J. Gascoyne; Sgt. W. G. Gawthorp; Sgt. J. Gilmour; Sgt. E. H. J. Groves; Sgt. R. S. Guy; Sgt. W. Harding; Sgt. R. Haslam; Sgt. A. W. Hover; Sqn. Ldr. D. W. S. Ireland; Sgt. R. A. J. King; Flt. Sgt. D. P. Langley; Sgt. D. Lewis; Act. Flt. Lt. B. K. Lindsay; Sgt. W. McCarron; Sgt. J. McKee; Sgt. R. McKenzie; Sgt. S. F. McLean; Sgt. G. McLoughlin; Flt. Lt. H. H. McMichael; Sgt. H. J. Martin; P/O. H. L. Martin; Flt. Lt. J. B. Michie; Sgt. R. Morton; Sgt. G. Moses; Sgt. J. Murtagh; Sgt. R. Pyper; Sgt. H. J. Read; Sgt. G. Scott; Sgt. R. Sinden; Sgt. F. C. Smith; Sgt. J. Smurthwaite; Sgt. B. M. Swallow; F/O. C. S. Thomas; F/O. J. A. Townsend; Sgt. D. W. Turner; Sgt. J. S. Turner; Sgt. H. B. Vine; Sgt. P. A. Waller; P/O. K. F. Wandless; Sgt. S. F. Watt; Sgt. H. J. West; Sgt. K. Westhorp; F/O. R. D. White; Sgt. J. L. Whyte; Sgt. C. Wignall; Sgt. A. J. Wilkinson; P/O. A. L. Worsley.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. D. A. Brown; P/O. C. W. H. Cocks; Sgt. J. Doran; Flt. Sgt. R. Eadie; Sgt. T. J. Henry; Flt. Lt. R. F. Lind.

KILLED ON ACTIVE SERVICE.—Sgt. K. H. Austin, Sgt. R. Badcock; F/O. B. H. Balley; Sgt. C. F. Beechey; Sgt. L. Bill; L.A/C. R. H. Bryson; P/O. W. Burt; Sgt. K. Clithero; Sgt. J. Coaker; Sgt. W. H. Donnelly; Sgt. F. J. Emberson; Sgt. R. P. Enright; Sgt. J. Gibson; Sgt. G. A. Hitchen; L.A/C. G. H. Ironmonger; Sgt. P. V. Jerome; Sgt. J. J. Kenny; Sgt. E. J. Loverock; Sgt. H. Lowe; L.A/C. O. Loy; A/C.1 D. Mann; Sgt. J. McGinnes; Sgt. A. L. McLachlan; Sgt. M. McMillan; Flt. Sgt. J. C. McPherson; L.A/C. W. Melville; Sgt. F. H. Mitchell; Sgt. T. R. Newton; Sgt. G. C. Nielsen; Sgt. R. J. Preece; Sgt. C. A. Ravenette; Sgt. F. J. Richardson; Sgt. T. J. Ruff; Sgt. A. Sephton; Sgt. J. Sinden; Sgt. G. D. Singleton; Sgt. N. J. G. Smith; Sgt. H. J. Sterne; Sgt. T. J. Symons; F/O. R. S. Tovey; P/O. J. R. Walker; Sgt. T. J. Whalley; Sgt. J. M. Whitehead; Sgt. F. G. Wilkinson; P/O. A. B. Wilson; Sgt. T. Wishart.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 G. M. Barrett; Sgt. G. J. Bender; L.A/C. J. H. Green; W/O. J. D. Loach; L.A/C. J. A. Piller; F/O. G. Shadforth; L.A/C. D. R. Woodhatch.

DIED ON ACTIVE SERVICE.—L.A/C. J. Adams; F/O. F. Astles; L.A/C. E. O. Brian; A/C.1 C. F. Brown; A/C.2 J. Bruce; L.A/C. J. W. Buckley; L.A/C. F. W. Dance; L.A/C. J. W. Downer; Act. Cpl. W. Gledhill; Cpl. C. H. Goldman; Cpl. E. W. Hobbs; A/C.2 W. A. T. Lambert; A/C.2 D. Lang; L.A/C. J. W. Lines; A/C.2 H. Mills; A/C.1 W. S. Mills; A/C.2 J. F. Norwood; Flt. Sgt. F. M. Page; Cpl. R. Roberts; Cpl. S. Schofield; Sgt. B. Shaw; A/C.2 J. E. Shorrocks; A/C.2 C. J. Skelding; A/C.2 E. H. Stanbrook; A/C.1 J. Thomson; L.A/C. R. H. Trafford; A/C.1 W. Vowell; A/C.2 W. Walker; L.A/C. J. G. Walter; Cpl. E. W. Wheeler; Cpl. J. H. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. T. M. Grice; Sgt. H. Helleweil; Sgt. B. J. Landen; Sgt. C. T. Ord; Sgt. A. V. Rimes.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. R. A. Frost; A/CW.2 E. Higgins; A/CW.1 D. Oliver.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. R. G. A. Brathwaite; P/O. A. S. Jones.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. Conlon; Flt. Sgt. S. C. Methven.

MISSING.—Sgt. W. E. J. Austin; Sgt. A. H. Bransby; Sgt. E. A. Day; Sgt. H. A. McLennan; Sgt. N. T. Mason; Sgt. S. J. Mathews; Flt. Sgt. L. A. Morgan; Sgt. H. B. Oliver; Sgt. L. L. Rodgers; Sgt. G. R. Sedger; Flt. Sgt. J. F. Thomas.

KILLED ON ACTIVE SERVICE.—Sgt. M. H. Barnett; P/O. B. O. Bown; Sgt. J. R. Gilbert; Sgt. J. A. Gilpin; P/O. J. F. Herbert; Sgt. E. O Knight; Sgt. R. D. Lewis; Sgt. A. D. Lyon; Sgt. A. R. Mackay.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. M. J. Barbe; Sgt. J. Currie; Sgt. R. R. Harrisson; Sgt. R. C. Marchant; P/O. C. E. Mercer; Flt. Sgt. T. A. Pertus; Flt. Sgt. J. W. Wilson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. W. V. Clarke; Sgt. J. D. Creede; P/O. W. S. Findlay; Sgt. J. W. Macauley; Sgt. W. E. Mander; Sgt. A. B. Martin; Flt. Sgt. W. A. Penney; P/O. D. A. Street.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. V. F. McHargh; Sgt. W. A. L. Masterman; Sgt. M. E. Putnam.

MISSING.—Sgt. G. J. Beresford; Sgt. F. C. Bitten; Sgt. H. L. Brown; Flt. Sgt. C. J. Carmody; Flt. Sgt. T. E. Case; Flt. Sgt. A. F. Guillemette; F/O. W. K. Komaiko; Flt. Sgt. J. A. A. Poirier; Sgt. R. W. Rea; Sgt. L. J. Switzer; Flt. Sgt. P. Y. C. Tremblay; P/O. H. Welch.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—W/O. J. H. Clark.

KILLED ON ACTIVE SERVICE.—P/O. G. F. Brown; Sgt. J. S. Cornfield; Sgt. D. J. Farrell; P/O. R. P. Love; P/O. D. R. A. Macdougall; Sgt. M. S. Kahn; Sgt. J. V. O'Neill; Flt. Sgt. H. J. Palmer; Sgt. A. C. C. Piercey; Sgt. J. J. Snyder; P/O. W. B. C. Thompson; Sgt. T. H. Warne; P/O. I. M. Wilson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. G. M. Manning.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. K. C. Billing; Sgt. C. C. Brownlee; Sgt. D. M. L. McKenzie.

MISSING.—Sgt. N. C. Beer; Sgt. E. Cuthbert; Sgt. W. J. Veysey.

KILLED ON ACTIVE SERVICE.—Sgt. D. C. Rowse.

South African Air Force

KILLED IN ACTION.—Lt. N. A. Freeman.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED PRISONER OF WAR.—Lt. F. J. Schofield.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. A. Hill.

Official Corrections

To Casualty Communiqué No. 215.

Under "KILLED ON ACTIVE SERVICE" for Act. Flt. Lt. A. STEPHENSON read Act. Flt. Lt. A. STEPHENSON, D.F.M., R.C.A.F. Under "MISSING," for Sgt. R. T. HANBRIDGE read P/O. R. T. HANBRIDGE.